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Book Reviews

Bronchoscopy, Esophagoscopy and Gastroscopy. A Manual of Peroral Endoscopy and Laryngeal Surgery. By Chevalier Jackson, M.D., and Chevalier L. Jackson, M.D. Third edition. Price, $9. Pp. 485, with 225 illustrations and 15 color plates. Philadelphia: W. B. Saunders Company, 1934.

The title explains the scope of this manual, which the reviewer does not hesitate to pronounce the most important and most complete statement that has yet appeared in the field of bronchoscopy, esophagoscopy and gastroscopy. There is no effort to record progress in this field historically, but the aim is rather to present clearly the basic points. The enormous widening of the field of bronchoscopy for diseases of other than foreign-body origin has necessitated rewriting the chapters dealing with the various phases of bronchoscopy. The book is based on the authors' own clinical experience, in which there exists no claim for priority.

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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 20 AUGUST 1934 NUMBER 2

TREATMENT OF LABYRINTHITIS

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AND
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No comprehensive discussion of any phase of labyrinthitis should be undertaken without at least mentioning the contributions of such pioneers as Duverney,[1] who in 1684 described pus in the middle ear, vestibule, semicircular canals and cochlea; of Leschevin,[2] who fifty years later noted caries of the labyrinth and superior surface of the petrous pyramid, that went on to meningitis; of Morgagni,[3] who described suppuration in the tympanum with caries of the facial canal and the semicircular canals and a collection of pus between the dura and the posterior surface of the petrous pyramid, and of Itard,[4] who first noted the association of vertigo and vomiting with aural disease. In 1827 Saissy [5] reported two cases in which he found pus in the inner ear. In these earliest communications we have the foundation for both the pathology and symptomatology of labyrinthine infections; a foundation on which the superstructure of therapy in labyrinthine disease has been built.

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1. Duverney, J.-G.: Tractatus de organo auditus, continens structuram, usum et morbos omnium auris partium, Norimbergae, imp. J. Ziegeri, 1684.

2. Leschevin: Mémoire sur la théorie des maladies de l'oreille, [Courronné en 1763], Mém. pour les prix de l'Acad. roy. de chir., Paris, 1819, vol. 4, p. 85; quoted by Hinsberg: Die tympanogene Labyrinthentzündung, in Denker, A., and Kahler, O.: Handbuch der Hals-, Nasen- Ohrenheilkunde, Berlin, Julius Springer, 1926, vol. 7, p. 439.

3. Morgagni, G. B.: De sedibus et causis morborum per anatomen indagatis libri quinque, Lovanii, e. typog. academica, 1766-1767.

4. Itard, J. M. G.: Traité des maladies de l'oreille et de l'audition, Paris, Méquignon and Marvis, 1821.

5. Saissy, J.-A.: Essai sur les maladies de l'oreille interne, Paris, J. B. Baillière et fils, 1827, p. 243.

Wilde,[6] Toynbee,[7] von Tröltsch,[8] Bezold,[9] Habermann,[10] Politzer,[11] Gruber,[12] Schwartze [13] and Gradenigo [14] laid the groundwork for the present day clinical concept of labyrinthitis, but it remained for Jansen [15] in 1893 to establish the anatomicopathologic basis for the understanding of tympanogenic labyrinthitis. We are also indebted to Jansen [16] for the description of the technical procedure of the operation on the labyrinth and for the establishment in 1900 of definite indications for its use. Mention must also be made of Richards [17] who in 1907, in an excellent contribution, described the operation named after him for the treatment of suppurative labyrinthitis. He is another of the notable pioneers in labyrinthine surgery.

The histologic studies of temporal bones by Alexander,[18] Barnick,[19]

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6. Wilde, W. R. W.: Practical Observations on Aural Surgery and the Nature and Treatment of Diseases of the Ear, Philadelphia, Blanchard and Lea, 1853.

7. Toynbee, J.: The Diseases of the Ear, Philadelphia, Blanchard and Lea, 1860.

8. von Tröltsch, A. F.: Gesammelte Beiträge zur Pathologie des Ohres, Leipzig, F. C. W. Vogel, 1883, p. 256.

9. Bezold, F.: Labyrinthnekrose und Paralyse des Nervus facialis, Munich, J. F. Bergmann, 1886.

10. Habermann, J.: Ueber die tuberkulose Infektion des Mittelohres, Ztschr. f. Ohrenh. **6**:367, 1885.

11. Politzer, A.: Labyrinthbefunde bei chronischen Mittelohreiterung, Arch. f. Ohrenh. **65**:161, 1905; **85**:155, 1911.

12. Gruber, J.: Bemerkungen über den Canalis caroticus mit Bezug auf praktische Ohrenheilkunde, Monatschr. f. Ohrenh. **31**:1, 1897.

13. Schwartze, H.: Handbuch der Ohrenheilkunde, Leipzig, F. C. W. Vogel, 1892-1893.

14. Gradenigo, G.: Krankheiten des Labyrinthes und des Nervus acusticus, in Schwartze.[13]

15. Jansen, A.: Zur Kenntnis der durch Labyrintheiterung induzierten, tiefen extra-duralen Abscesse der hinteren Schädelgrube, Arch. f. Ohren-, Nasen- und Kehlkopfh. **35**:290, 1893.

16. Jansen, A.: Operationen am Labyrinth, Blau's Enzyklopädie der Ohrenheilkunde, Leipzig, F. C. W. Vogel, 1900, p. 202.

17. Richards, J. D.: Treatment of Purulent Affection of the Labyrinth, Consecutive to Disease of the Middle Ear, Ann. Otol., Rhin. & Laryng. **16**:564 (Sept.) 1907.

18. Alexander, G.: Ueber chronische zirkumskripte Labyrintheiterung, Ztschr. f. Ohrenh. **61**:254, 1910.

19. Barnick, O.: Klinische und pathologisch-anatomische Beiträge zur Tuberkulose des mitteleren und inneneren Ohres, Arch. f. Ohrenh. **40**:81, 1893.

Göerke,[20] Manasse,[21] Ruttin,[22] Hegener,[23] Scheibe,[24] Siebenmann,[25] Neumann,[26] Mayer,[27] Wittmaack,[28] Brock [29] and many others too numerous to mention have broadened our clinical concept of labyrinthitis and have made it possible to appreciate the conflicting problems that beset the otologist in the care of this condition.

The literature emanating from clinics all over the world is rife with reports of observers who have occupied themselves with the intriguing problem of surgical indications in labyrinthine infections. From the correlation of the clinical picture of labyrinthitis with the histologic studies the following classification of labyrinthine infections has developed: (1) circumscribed labyrinthitis, (2) diffuse serous labyrinthitis, (3) diffuse manifest suppurative labyrinthitis and (4) latent labyrinthitis. Alexander [30] divided labyrinthitis into (1) serous otitis interna, (*2a*) suppurative para-otitis interna, (*2b*) suppurative periotitis interna, (*3a*) suppurative periotitis interna with or without fistula, (*3b*) diffuse suppurative uncomplicated otitis interna, (*4a*) suppurative complicated otitis interna and (*4b*) meningitis and otitis interna.

Perhaps the simplest and most practical of all is the classification proposed by Rae,[31] who divided labyrinthitis into (1) acute diffuse labyrinthitis, (2) chronic diffuse labyrinthitis, (3) paralabyrinthitis (*a*)

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20. Göerke, M.: Die entzündlichen Erkrankungen des Labyrinths, Arch. f. Ohrenh. **80**:1, 1909.

21. Manasse, P.: Zur pathologischen Anatomie des inneren Ohres und des Hörnerven, Ztschr. f. Ohrenh. **44**:41, 1903.

22. Ruttin, E.: Beiträge zur Histologie der Labyrintheiterungen, Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres **1**:388, 1908; Histologische Studien über die Veränderungen der tympanalen Labyrinthwand bei radikal operierten Fällen chronischer Mittelohreiterung, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **76**:81, 1908.

23. Hegener, J.: Labyrinthitis und Hirnabscess, Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres **2**:359, 1909.

24. Scheibe, A.: Ueber induzierte Labyrinthitis, Verhandl. d. deutsch. otol. Gesellsch. **21**:210, 1912.

25. Siebenmann, F.: Die Blutgefässe im Labyrinthe des menschlichen Ohres, Munich, J. F. Bergmann, 1894, p. 33.

26. Neumann, H.: Ueber circumscripte Labyrintheiterung, Verhandl. d. deutsch. otol. Gesellsch., 1907, p. 267.

27. Mayer, O.: Zur Entstehung der sogenannten Labyrinthitis serosa im Verlauf akuter Mittelohrentzündungen, Monatschr. f. Ohrenh. **43**:601, 1909.

28. Wittmaack, K.: Beiträge zur pathologischen Anatomie des Gehörorgans, Ztschr. f. Ohrenh. **47**:123, 1904.

29. Brock, W.: Klinische und pathologisch-anatomische Studien über die Frage der Labyrintheiterung, Ztschr. f. Ohrenh. u. f. Krankh. d. Luftwege **66-67**: 267, 1912-1913.

30. Alexander, G.: Zur Behandlung und operativen Indikationstellung der eitrigentzündlichen Innenohrerkrankungen, Monatschr. f. Ohrenh. **61**:898 (Aug.) 1927.

31. Rae, J. B.: The Diagnosis of Inflammatory Diseases of the Labyrinth, New York State J. Med. **16**:401, 1916.

with fistula and (*b*) without demonstrable fistula. Duel [32] offers the following slight amendment to Rae's classification of labyrinthitis: (1) acute endolabyrinthitis, (2) chronic endolabyrinthitis (3) paralabyrinthitis (*a*) with fistula and (*b*) without demonstrable fistula.

Despite the voluminous literature on this subject with its innumerable reports of cases there still exists a wide difference of opinion with regard to the surgical therapy in some forms of labyrinthine disease. However, there is considerable accord as to the treatment of circumscribed labyrinthitis. We use the term circumscribed labyrinthitis to signify disease of the labyrinthine bony capsule without diffuse involvement of the endolabyrinthine structures. Nearly all agree that the treatment for this condition is careful and complete radical mastoidectomy. It is perhaps unwise to attempt skin grafting on such a radical cavity at the primary operation. Alexander,[30] Duel,[32] Richards,[17] Zange,[33] Hinsberg,[34] Wittmaack,[35] Neumann,[36] Scheibe,[37] Uffenorde,[38] Page,[39] Perkins,[40] Fisher,[41] Törne,[42] Ramadier,[43] Turner and Fraser,[44]

32. Duel, A. B.: Suppurative Labyrinthitis: A Critical Review of Its Diagnosis and Treatment, Boston M. & S. J. **76**:345 (March 8) 1917.

33. Zange, J.: Konservative und chirurgische Behandlung der entzündlichen Erkrankungen des Innenohres mit besonderer Berücksichtigung der Indikationsstellung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:1, 1928.

34. Hinsberg, V.: Die tympanogene Labyrinthentzündung, in Denker, A., and Kahler, O.: Handbuch der Hals-, Nasen- u. Ohrenheilkunde, Berlin, Julius Springer, 1926, p. 439.

35. Wittmaack, K.: Die entzündlichen Erkrankungsprocesse des Gehörorgans, in Henke, F., and Lubarsch, O.: Handbuch der speziellen pathologischen Anatomie und Histologie, Berlin, Julius Springer, 1926, vol. 12, p. 276.

36. Neumann, H.: Operative Labyrinthschädigung; Befund nach 20 Jahren, Monatschr. f. Ohrenh. **60**:574, 1926.

37. Scheibe, A.: Durchbruch in das Labyrinth, insbesondere bei der akuten Form der Mittelohreiterung, Verhandl. d. deutsch. otol. Gesellsch. **7**:123, 1898.

38. Uffenorde, W.: Zur Klinik der Eiterungen des Ohrlabyrinths, Leipzig, Curt Kabitzsch, 1913; Monatschr. f. Ohrenh. **6**:885, 1913; Zur Klinik der Fälle von Mittelohr-Eiterung mit tiefen perilabyrinthären Herden, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **105**:87, 1919-1920; Versammlung der südwestdeutschen Hals-, Nasen- u. Ohrenärzte, Würzburg, March 9, 1924; Folia oto-laryng. **25**:28, 1924-1925.

39. Page, J. R.: Indications and Contra-Indications for Operating upon the Labyrinth, South. M. J. **24**:31 (Jan.) 1931.

40. Perkins, C. W.: Indications for the Labyrinth Operation, with Report of Three Cases of Meningitis, Laryngoscope **26**:1012 (July) 1916.

41. Fisher, J.: Die Indikationen zum chirurgischen Eingriff am Innenohr, Arch. f. klin. Chir. **140**:198, 1926.

42. Törne, F. W.: Beiträg zur Kenntnis der Behandlung der tympanogenen Labyrinthiten, Acta oto-laryng., supp. 9, 1929, p. 56.

43. Ramadier, J.: Indications thérapeutiques dans les labyrinthites infectieuses otogènes, Ann. d'oto-laryng., 1931, p. 42.

44. Turner, A. L., and Fraser, J. S.: Labyrinthitis: Complication of Middle Ear Suppuration; Pathology of Labyrinthitis, J. Laryng. & Otol. **43**:609 (Sept.) 1928.

Watson-Williams,[45] Rendu [46] and many others are in complete accord as to this manner of treating circumscribed labyrinthitis.

Ruttin [47] also holds this view, but in his book he mentioned the following exceptions to the generally accepted method of handling this type of labyrinthitis: 1. He expressed the belief that "labyrinthectomy may be necessary when a meningitis develops from a circumscribed labyrinthitis," but he stated that this is rare, as shown by histologic specimens. With regard to this circumstance we believe that in these cases the histologic proof of an extension to the meninges is so rare and other pathways of extension to the meninges are so frequent that it seems as if labyrinthectomy had little therapeutic value as compared with exploration elsewhere. 2. Labyrinthectomy may be performed "when deep extradural or cerebellar abscesses are present and so located that it is technically impossible to drain them unless the labyrinth be sacrificed." We have seen one instance of an abscess in the wall of the internal auditory meatus that would justify this procedure. This could not be diagnosed clinically because it was already associated with a cerebellar abscess and was found only on postmortem histologic examination. 3. It may also be performed "when there exists strong suspicion that a cerebellar abscess is present, and there is a fistula in the labyrinth. In such a case, the labyrinth fistula with its attendant nystagmus complicates the diagnosis." Ruttin believes that it is permissible to eliminate the labyrinth: "If shortly after labyrinthectomy the nystagmus ceases there probably is no cerebellar disease. But if after operation a nystagmus appears to the diseased side, or if the nystagmus varies from the sound to the diseased side, there is a strong probability of cerebellar disease." With the development of cerebral surgery and the tendency to delay exploration for an abscess of the brain to the limit of safety, we believe that we can rely on the symptomatology and clinical course of the lesion in the brain without the necessity of a labyrinthectomy to help establish a diagnosis. 4. Labyrinthectomy seems indicated "to relieve intractable vertigo; this is very rare since the dizziness in circumscribed labyrinthitis, though at times severe, usually subsides and disappears." So far as the instances of intractable vertigo are concerned, section of the eighth nerve in the internal auditory meatus performed in a clean field would appeal to us much more than the risk of establishing a direct communication between the infected ear and the subarachnoid space by labyrinthectomy. 5. Labyrinthectomy may be performed "where there

45. Watson-Williams, E.: Labyrinthitis: Remarks with Special Reference to Treatment of Cases Shown to Bristol Medico-Chirurgical Society, 1924, Bristol Med.-Chir. **41**:135 (July) 1924.

46. Rendu, A.: De la trépanation du labyrinthe dans les labyrinthites chroniques, Thèse de Paris, no. 91, Paris, M. Steinheil, 1909.

47. Ruttin, E.: Diseases of the Labyrinth, New York, Rebman & Co., 1914.

is widespread sequestration." While Hinsberg [48] and Friedrich [49] advocated early sequestrotomy, on the other hand Schmiegelow [50] and others believe that there should be no interference whatever and that sequestrums should be allowed to extrude themselves spontaneously. At all events in the handling of widespread sequestration in this region a situation may develop which is tantamount to a traumatic labyrinthitis and thus justify an immediate labyrinthectomy, despite the presence before operation of function or irritability.

In summing up, it appears that, with consideration of the definite pathologic changes that take place in a circumscribed labyrinthitis and its clinical course, there is complete accord as to the method of treatment.

Latent labyrinthitis is a condition in which the labyrinth has been the seat of a diffuse inflammatory process which has resulted in the total loss of function and of irritability and from which there are no longer any so-called labyrinthine symptoms. In order to appreciate the significance of this condition, one must digress for a moment to consider the pathologic changes which may occur in the endolabyrinthine spaces as sequences of such diffuse inflammation! 1. the labyrinthitis may heal, and still the endolabyrinthine spaces may be filled with fluid and communicate directly with the subarachnoid space. 2. The labyrinth may be the site of reparative processes, which may arouse a rapid formation of new bone, and the endolabyrinthine spaces may be partially or completely filled with this new bone. Von Brühl,[51] Zange,[52] Manasse,[53] Ruttin,[22] Politzer [11] and others have described such histologic observations.

With regard to these two forms of latent labyrinthitis it must be obvious that no dependence as to surgical indications can be placed on the loss of function and of irritability; nor is the compensation phenomenon of Ruttin an adequate criterion. Even following extreme cases of labyrinthine necrosis, we have seen a reproduction of the promontory, concave instead of convex, analogous to the reproduced mastoid cortex,

48. Hinsberg, V.: Zur Therapie der Labyrinthsequester, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:221, 1928.

49. Friedrich, E. P.: Die Eiterung des Ohrlabyrinths, Munich, J. F. Bergmann, 1905.

50. Schmiegelow, E.: Erfahrungen über die während des Verlaufes der akuten und chronischen Mittelohr Suppurationen auftretende Labyrinthitis, Arch. f. Ohren. **79**:153, 1909.

51. von Brühl, G.: Zur Pathologie des Gehörorgans, Monatschr. f. Ohrenh. **46**:275, 1912.

52. Zange, J.: Pathologische Anatomie und Physiologie der mittelohrentspringenden Labyrinthentzündungen als Grundlage der Klinik; zugleich eine kurze Klinik dieser Erkrankungen, Munich, J. F. Bergmann, 1919.

53. Manasse, P.: Handbuch der pathologischen Anatomie des menschlichen Ohres, Munich, J. F. Bergmann, 1917.

as well as a bony closure of the oval window. Observations along these lines have been made by Lange,[54] Manasse [53] and Zange.[52]

Neither Dench [55] nor Richards was influenced in establishing surgical indications by the so-called functional tests. In several instances of the first variety of latent labyrinthitis Richards found the endolabyrinthine spaces filled with fluid, and he concluded that to operate on such a labyrinth is as serious as opening a normal labyrinth, since in both, one establishes a free communication between the infected middle ear and the subarachnoid space. In the second variety of latent labyrinthitis reparative processes have taken place in the endolabyrinthine spaces subsequent to the diffuse infection, and the labyrinth is filled more or less completely with new bone. There is a tendency for new bone to form rapidly within the infected labyrinth. According to Manasse [53] there are two varieties of new bone formation. There may be a direct metaplasia of the inflammatory products (granulations, etc.) or the bone may form from the endosteum and so concentrically narrow and even occlude the labyrinthine spaces. In either instance it is obvious that a labyrinth so filled with bone must be innocuous, no longer the seat of an active infection and no longer requiring any surgical intervention.

The third variety of latent labyrinthitis does not differ from the first two so far as the loss of function and of irritability is concerned. In these cases, however, operation discloses a communication between the labyrinth and the infected middle ear, aditus or antrum. This may be apparent either through the presence of a fistula in the bony capsule or through changes particularly about the oval window. It may be evident that cholesteatoma has invaded the labyrinth. In this third type of latent labyrinthitis what might be called normal reparative processes have not occurred, and even though there may be no symptoms, there still remains an active infectious process in the endolabyrinthine spaces. Such a labyrinth may be the seat of necrosis or even of sequestration. It should not be regarded in any other light than as an unusually situated diseased mastoid cell which must be exenterated.

When this form of labyrinthitis is associated with any signs or symptoms indicative of an extension to the intracranial contents, it seems advisable that, combined with the labyrinthectomy, a wide exposure of the dura of both the middle and the posterior fossae, with a careful search for an extradural abscess, be made.

It is particularly in this form of labyrinthitis that the latent infection in the labyrinthine spaces may be activated by the trauma to the sur-

54. Lange, W.: Beiträge zur pathologischen Anatomie der vom Mittelohr ausgehenden Labyrinthentzündungen, Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres **1**:1, 1908.

55. Dench, E. B.: Some Remarks on Labyrinthine Surgery, Laryngoscope **35**: 579 (Aug.) 1925.

rounding tissues incident to radical mastoidectomy, and rapid extension to the intracranial contents may result unless a labyrinthectomy is performed coincident with the radical operation on the mastoid. The reports of Günther,[56] Jansen,[57] Page,[39] Alexander,[30] Duel,[32] Neumann,[36] Uffenorde,[38] Watson-Williams,[45] Turner and Fraser,[44] Perkins,[40] Kerrison,[58] Törne,[42] Zange,[33] Ruttin,[59] Rockemer [60] and others are in accord with these views.

In summing up the attitude toward latent labyrinthitis we can do no better than quote from Page's [39] excellent article, "advanced necrosis in dead labyrinths during the mastoid operation presents no problems."

We have purposely reserved for the last the consideration of the form of labyrinthitis concerning which the widest differences of opinion still exist. While on the one hand Voss,[61] Scheibe,[37] Alexander,[30] Fisher,[41] Phillips,[62] Page,[63] Milligan,[64] Thacker Neville, [65] Jobson,[66] Smith,[67] Cunning,[68] Perkins,[40] Seydell,[69] Ramadier [43] and Ardouin [70] advocate

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56. Günther: Die Resultate und die Indikationen der Labyrinthoperation, Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres **23**:217, 1926.

57. Jansen, A.: Treatment of Infective Labyrinthitis After Fifteen Years Experience, Ann. Otol., Rhin. & Laryng. **17**:367, 1907.

58. Kerrison, P. D.: Clinical Studies of Five Cases of Suppurative Labyrinthitis, Laryngoscope **21**:161 (March) 1911.

59. Ruttin, E.: Die konservative und chirurgische Behandlung der Entzündlichen Erkrankungen des Innenohres, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:104, 1928.

60. Rockemer, K.: Die tympanogene Labyrinthentzündung der Heidelberger Klinik in den Jahren 1920-1926, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:379, 1927.

61. Voss, O.: Klinische Beobachtungen über nichteitrige Labyrinthentzündung im Verlauf akuter und chronischer Mittelohreiterung, Verhandl. d. deutsch. otol. Gesellsch. **18**:145, 1908.

62. Phillips, W. C.: Clinical Types of Labyrinthitis with Comments on Treatment, J. A. M. A. **68**:336 (Feb. 3) 1917.

63. Page, J. R.: Case of Chronic Suppurative Otitis Media with Labyrinthine Symptoms, Laryngoscope **39**:497 (Aug.) 1929.

64. Milligan, W.: Surgical Treatment of the Suppurative and Certain Non-Suppurative Affections of the Labyrinth, J. Laryng. & Otol. **39**:245, 1924.

65. Thacker Neville, W. S.: Case of Labyrinthitis Complicating Acute Otitis Media, J. Laryng. & Otol. **46**:621 (Sept.) 1931.

66. Jobson, T. B.: Chronic Suppurative Otitis Media with Cholesteatoma: Acute Labyrinthitis and Meningitis, Proc. Roy. Soc. Med. **25**:1476 (July) 1932.

67. Smith, J. M.: Labyrinthine Surgery, New York M. J. **116**:85 (July 19) 1922.

68. Cunning, D. S.: Some Clinical Observations on Labyrinthitis, Laryngoscope **43**:383 (May) 1933.

69. Seydell, E. M.: Tympanogenous Labyrinthitis During Acute Otitis Media in Its Early Stage or in Its Serous Stage, Tr. Am. Laryng., Rhin. & Otol. Soc. **36**:535, 1930.

70. Ardouin, P.: Les réactions séreuses du labyrinthe au cours de l'otite moyenne aiguë, Prat. méd. franç. **14**:181 (March) 1933.

conservatism even to the extent, in the instance of Scheibe, of immobilization of the head and body with starched bandages in these cases, yet on the other hand an equally large group of observers including Hinsberg,[54] Neumann,[56] Bárány,[71] Leidler [72] and others advocate an extremely radical course. If one can draw any conclusions at all from these facts, it appears to us that cases of labyrinthitis presenting primarily identical symptomatology differ in the widest possible degree in the tendency to become limited and localized, and to heal and not extend to the intracranial contents. If this is true, and we believe it is, it follows that each case of diffuse manifest labyrinthitis must be considered individually as to therapy; if this were not true these differences of opinion would be utterly unintelligible.

It has been customary to divide acute manifest labyrinthitis into two groups: (1) serous and (2) suppurative. As a matter of fact, this grouping has resulted from an attempt to classify clinically identical phenomena on the basis of pathologic evidence. In other words, we have studied clinical phenomena through a microscope. We have fallen far short of the actual differentiation between these two states because the clinical criteria advanced have been inadequate to establish accurately such a differentiation. So-called serous labyrinthitis has been considered as a collateral edema or a "toxic reaction." The experimental work and findings reported by Grünberg,[73] Lange,[54] Mayer,[27] Nager,[74] Blau [75] and Herzog [76] are in accord with this theory, the actual infectious process, however, being limited to the middle ear or the mastoid. There has always been a question whether the barriers of the internal ear exercise such adequate selection that toxins, the products of bacterial growth, pass through them while the bacteria themselves are selectively excluded. We have always wondered whether there is an essential difference between serous and suppurative labyrinthitis, at least so far as an invasion by any micro-organism is concerned.

Nor do the so-called functional tests offer dependable criteria in the differentiation of these two states except that a labyrinth with function

71. Bárány, R.: Die Indikationen zur Labyrinthoperation, Acta oto-laryng. **6**:260, 1924.

72. Leidler, R.: The Indications for Opening the Labyrinth, J. Laryng. & Otol. **41**:641 (Oct.) 1926.

73. Grünberg, K.: Beiträge zur Kenntnis der Labyrinth-Erkrankungen, Ztschr. f. Ohrenh. **48**:67, 1909.

74. Nager, F. R.: Wissenshaftlicher Bericht der oto-larynogologischen Klinik (Siebenmann) Basil, Monatschr. f. Ohrenh. **53**:215, 1907.

75. Blau, L.: Experimentelle Labyrinthitis, Verhandl. d. deutsch. otol. Gesellsch. **21**:238, 1912.

76. Herzog, H.: Labyrintheiterung und Gehör, Munich, J. F. Lehmann, 1907, p. 133; "Heilungsvorgänge" im (experimentell) erkrankten Labyrinth, Verhandl. d. deutsch. otol. Gesellsch. **22**:384, 1913.

or irritability rarely causes a meningitis. Yet, on the one hand, in experimental labyrinthitis in animals Herzog,[76] Haymann,[77] Schötz [78] and others have shown that caloric irritability was retained despite the fact that histologic examination showed the labyrinth to be full of pus; on the other hand some investigators, notably Page,[63] have had cases of diffuse manifest labyrinthitis in which total loss of function and of irritability occurred during the height of the labyrinthine symptoms, yet the process went on to healing with the restoration of considerable function. In the maze of contradictory evidence it becomes necessary to discard much of what was previously held unquestioned and to hark back to sound clinical sense. After all, failure to differentiate between serous and suppurative labyrinthitis is not so serious provided that, as the result of careful clinical observation and experience, we can substitute for it knowledge as to which form of labyrinthitis is grave.

TYPES OF LABYRINTHITIS

At the outset clinical experience has shown that, depending on their origin certain types of labyrinthitis are much more serious than others. Perhaps a grouping of cases of diffuse manifest labyrinthitis along these lines would be helpful in establishing indications for surgical procedure.

Traumatic Labyrinthitides.—There is no question in our minds that the variety of labyrinthitis which occurs consequent on the evulsion of the stapes during the performance of a radical operation on the mastoid is an extremely serious condition frequently followed by an extension of infection to the meninges. We believe that patients with this complication should be afforded whatever safeguard can be given them by an immediate labyrinthectomy. Richards,[17] Fremel,[79] Hinsberg [34] and Neumann [36] are in complete accord with this view. However, Zange,[33] Ruttin,[59] Voss,[61] Jansen,[57] Scheibe [24] and others believe that equally good results are obtained by treating these patients conservatively. If alarming symptoms ensue, they perform a labyrinthectomy.

Extensive Necrosis of the Petrous Pyramid.—We believe that in a case of extensive necrosis of the petrous pyramid when the removal of a sequestrum or necrosed bone entails the opening of the endolabyrinthine spaces, a labyrinthectomy offers a better chance than conservative waiting.

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77. Haymann, L.: Experimentelle Studien zur pathologischen Anatomie der akut entzündlichen Processe im Mittelohr und Labyrinth, Arch. f. Ohrenh. **95**:199, 1914.

78. Schötz, W.: Histologische und experimentelle Beiträge zur Pathologie der otogenen Labyrinthitis, Arch. f. Ohrenh. **86**:214, 1911.

79. Fremel, F., quoted by F. G. Sprowl: Ann. Otol., Rhin. & Laryng. **40**:255, 1931.

Diffuse Manifest Labyrinthitis.—In the type of diffuse manifest labyrinthitis that occurs late after an infection of the middle ear, particularly in the presence of a latent mastoiditis, the tendency toward limitation of the process to the labyrinth and healing is extremely small and the possibility of extension to the cranial contents menacing. This represents one of the most disastrous types of labyrinthine infection and requires not only exenteration of the labyrinth but also an exposure and search of the dura of both the middle and the posterior fossae. There is no difference of opinion concerning the handling of these cases.

Labyrinthitis Occurring with Acute Otitis Media.—In the type of labyrinthitis that occurs with acute otitis media, particularly when the labyrinth is involved during the first few days of the otitis, a more conservative attitude can be taken. In this group one should also include cases of labyrinthitis that follow shortly after a myringotomy and are probably traumatic. Apparently the annular ligament of the oval window may be torn by dislocation of the stapes. Total deafness with loss of irritability may follow rapidly, and yet the endolabyrinthine spaces may be infected either mildly or not at all. In other words, it is quite conceivable that trauma alone may be the cause of a loss of labyrinthine function without serious infection of the interior of the labyrinth. We believe that in this type of case nothing is lost through conservative treatment. Even when acute infection of the middle ear is associated with an acute mastoiditis, we have waited as long as possible, in several instances until the end of the third week of the acute otitis, before exenterating the mastoid. In such a case we have used neither chisel nor gouge, but have employed the rongeur exclusively in the removal of the cortex after the method shown to one of us (I. F.) years ago by Duel. We have not opened the labyrinth. We have had comparatively few patients with this condition and have lost none.

One must grant that these patients are in imminent danger of an extension of the process to the meninges. We are in accord with Zange,[33] Brock,[80] Braksieck,[81] Güttich,[82] Page,[39] Ruttin [59] and Scheibe [87] in believing that cases of labyrinthitis complicating acute otitis show a higher incidence of mortality from meningitis than cases of labyrinthitis following chronic suppuration of the middle ear. Yet we firmly believe it inadvisable to operate on all such patients indiscriminately so long as there are no evidences indicative of an extension of the infection

80. Brock, W.: Indikationen zur Labyrinth Chirurgie an der Erlanger Klinik, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:196, 1928.

81. Braksieck, H.: Zur Therapie und Prognose der unkomplizierten und komplizierten Labyrinthitiden mit Funktionsresten und ohne Funktionsreste, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **118**:184, 1928.

82. Güttich, A.: Zur Klinik der labyrinthentspringenden Meningitis, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:183, 1928.

beyond the confines of the labyrinth proper. We realize, of course, that this is debatable ground. Hinsberg [83] is opposed to this view; he recently stated that since the expectant treatment results in a high mortality he believed immediate operation should be tried in this condition as well as in the labyrinthitis following chronic suppuration of the middle ear.

The labyrinthitis that is associated with chronic suppuration of the middle ear and that occurs either in the course of the disease of the middle ear or after the radical operation on the mastoid belongs to a group that is decidedly more innocuous than either traumatic labyrinthitides or those complicating acute suppurative otitis and mastoiditis. It is particularly in this group that careful observation can frequently differentiate between a grave or menacing labyrinthitis and one that probably will go on to spontaneous healing.

However, we believe that if fever, headache or any other clinical evidences, no matter how slight, of an extension to the meninges supervene while these patients are under observation, a labyrinthectomy should be performed. Holmgren [84] and Ruttin [47] made the observation that a sudden rise in temperature after the onset of the acute labyrinthitis generally signified a serious complication. Page [39] definitely believes that frequently repeated lumbar punctures as advocated by Lund [85] and Fleischmann [86] are of more than theoretical harm in breaking down protective barriers to the spread of the infection to the subarachnoid space. Whether or not careful lumbar puncture is an innocuous procedure in these cases if practiced repeatedly is problematic. We are inclined to use this diagnostic measure only when it is definitely indicated.

We have no evidence that would lead us to believe that repeated lumbar puncture and cytologic study of the spinal fluid alone can give criteria that might be used as a definite index of the degree or rapidity of extension to the meninges and so furnish the operative indication for labyrinthectomy.

Lund, who is a protagonist for the use of lumbar puncture and cell count as an indication for labyrinthectomy, made the following statement "If one does not start with the fact that normal cerebro-spinal

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83. Hinsberg, V.: Cases of Labyrinthitis Complicating Acute Otitis Media, Monatschr. f. Ohrenh. **64**:1263 (Nov.) 1930.

84. Holmgren, G.: Indications for the Labyrinth Operation, Acta oto-laryng. **6**:237, 1924.

85. Lund, R.: Die Indikationen der Labyrinthectomie im besonderen Hinblick auf die akute diffuse destruktive Labyrinthitis, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:204, 1927-1928.

86. Fleischmann, O.: Zur Frage des diagnostischen Wertes der Lumbalpunktion bei den cerebralen Komplikationen der Mittelohreiterung, Arch. f. Ohrenh. **102**:42, 1918.

fluid is free of cells and that consequently from 3 to 6 cells per cubic millimeter is without doubt of pathological significance, then studies of the cytology of the cerebro-spinal fluid are without value as an indication for labyrinthectomy." In Lund's [85] communication he published a table containing the report of several cases in which he performed a labyrinthectomy on the basis of a cell count on the cerebrospinal fluid, despite the fact that at the time of the examination hearing and caloric responses were present. This is an indication to which most physicians would not subscribe. Finally he said, in answer to Borries, Neumann, Hinsberg, and Zange who questioned the practicability of frequently repeated lumbar puncture as an index for operation, "It is almost a general rule that through accurate observation of the patient, with one or two lumbar punctures at the proper time the beginning of increased cells in the cerebro-spinal fluid can be determined."

This is essentially the attitude of most of those who believe that in labyrinthitis as in other conditions clinical phenomena are more valuable than laboratory data as indications for operation.

TUBERCULOSIS OF THE LARYNX

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In modern medicine, as in that of the past, tuberculosis may be regarded as the disease above all others whose battle-ground is the whole body. No part of the human organism is immune to it, and no single organ seems capable of localizing it. The reader must, therefore, be cautioned against taking the title of this article in its literal or restricted sense. No one whose work has brought him in constant contact with this disease can remain oblivious to the meaning of tuberculosis of the larynx or avoid the impression that it is only one of the many manifestations of a disease that most frequently embraces not organs alone, but whole systems of organs, and that only reluctantly retreats to one system. The latter is most apt to be the respiratory system, of which the larynx is an important part. Tuberculous disease of the larynx, whenever found, must, therefore, be looked on as either a part of generalized tuberculosis or of tuberculosis confined, to a greater or lesser degree, to the respiratory system. Primary tuberculosis of the larynx is not admissible as a diagnosis according to all authorities on the disease, and reports of such cases are open to grave doubts.

PATHOLOGIC CHANGES

According to Huebschmann,[1] laryngeal tuberculosis is almost invariably an accompaniment of the severe forms of pulmonary tuberculosis; that is, of the tuberculosis classified as type II and type III in the Turban-Gerhardt and National Tuberculosis Association classifications. It is most frequently met with in chronic tuberculosis, and does not, as a rule, play a part in the acute generalized forms such as miliary and caseous pneumonia. Genetically, it is most closely allied to tuberculosis of the large bronchi and trachea, and all three owe their involvement to the constant bathing of the mucous membranes in bacilliferous sputum, aided by the damage to the mucous membrane consequent on frequent and prolonged fits of coughing. In general, the more severe the pulmonary disease the more severe is that in the larynx, but exceptions are not at all uncommon, and one frequently finds severe laryngeal tuberculosis coexisting with mild tuberculous involvement, or only a mild

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1. Huebschmann, P.: Pathologische Anatomie der Tuberkulose, Berlin, Julius Springer, 1928, p. 289.

laryngitis or none at all in severe ulcerative pulmonary disease. In the former category one frequently finds the condition in pregnant tuberculous patients.

Manasse [2] has enumerated the following stages of tuberculosis as it affects the larynx: infiltration, ulceration, perichondritis and tumor formation. The most common of these and the most distressing to the patient is the stage of ulceration. The ulcers appear to localize by preference on the squamous epithelium of the vocal cords and to have an especial predilection for the vocal processes. According to Manasse the most common cause of this ulceration is the agglomeration of many tubercles under the mucous membrane, cutting off the blood supply of the latter and causing its ultimate death and exfoliation. Secondary infection of these exposed tubercles may occur, and the result is apt to be a large ragged ulcer whose floor is covered with caseous or purulent material and whose effect on the patient is familiar to all who deal with this manifestation of the disease. These lesions customarily spread to the ventricular bands, arytenoids and to the base of the epiglottis, interfering gravely with the normal functions of these structures. In a downward direction they spread to the mucous membrane of the trachea and large bronchi, where their presence and subsequent spread contribute to the syndrome of bronchial stenosis commonly seen in conjunction with severe laryngopulmonary tuberculosis.

Statistics vary somewhat as to the incidence of laryngeal tuberculosis in postmortem observations. Cooper and Benson [3] reported that of 798 autopsies performed at the Fitzsimmons General Hospital on patients in whom the cause of death was tuberculosis, 226, or 28.3 per cent, showed tuberculous laryngitis and an additional 4.8 per cent showed healed laryngeal lesions. Fetterlof, in a study of 100 postmortem examinations, found that laryngeal involvement had been present in 87 per cent.

SYMPTOMS

The early symptoms of laryngeal involvement are almost invariably those of some interference with the normal function of the larynx as an organ of speech. A change of voice occurs: either hoarseness, change of pitch, especially in females, or a need for more effort in phonation. To this may be added itching or "scratching" of the throat and paroxysmal, unproductive cough. Later symptoms are pain on phonation or deglutition, reflex otalgia and that peculiar sibilant whisper unmistakably the mark of the disease. In severe cases there may be

2. Manasse, quoted by Huebschmann.[1]

3. Cooper, A. T., and Benson, O. O.: A Study of the Laryngeal Effects of Collapse Therapy in Laryngopulmonary Tuberculosis, Am. Rev. Tuberc. **25**:186 (Feb.) 1932.

excruciating pain on swallowing, making the taking even of liquids an ordeal, and severe dyspnea and air hunger. In many of these very ill patients a syndrome occurs which should be examined more closely because of its importance to the ultimate prognosis in the case, i. e., the symptom complex now recognized as due to bronchial stenosis. The patient begins to complain of difficult breathing and severe dyspnea, usually without cyanosis. Respiration is labored, and the restlessness and apprehension of the patient indicate his acute consciousness of its being insufficient for his needs. There is deep incursion of the thoracic area overlying the lower end of the sternum. Examination of the larynx may show some constriction, but it usually indicates an ample airway. In far advanced tuberculosis this is an almost invariably fatal complication. Tracheotomy is erroneously resorted to in such instances and may at times give temporary relief, but death usually occurs as a result of stenosis of the finer bronchioles with atelectasis of large pulmonary areas.

STATISTICAL ANALYSIS

My experience with laryngeal tuberculosis derives from my connection, over a period of more than thirteen years, with a large sanatorium for tuberculous patients in the capacity of chief attending laryngologist. During this period of incumbency about 4,400 cases of tuberculosis have been examined in the laryngologic clinic of the institution and more than 1,000 cases of laryngeal tuberculosis diagnosed and treated. This report, however, is based on an analysis of the patients treated during the past five years at this sanatorium, which has a capacity of 450 beds and cares for from 750 to 800 patients yearly (see tables 1, 2 and 3).

In summary, 1,914 tuberculous patients were treated during this time; 1,208 were males and 706, females. Of the former, 304, or 25.1 per cent, had laryngeal tuberculosis; of the latter, 136, or 19.2 per cent. Of the 1,914 cases, 440, or 22.9 per cent, had this complication. Comparisons of these statistics with those of other writers show considerable variation, as may be expected, since different men use different criteria for estimating the degree and specificity of involvement of the larynx. In Bronfin and Markel's[4] excellent analysis, 79 per cent of the moderately advanced cases and 90 per cent of the far advanced cases were found to have tuberculous laryngitis. These are high figures, however, as compared with those of Parfitt,[5] who found 15.4 per cent, of Thomp-

4. Bronfin, I. D., and Markel, C.: The Upper Respiratory Tract in Pulmonary Tuberculosis with Special Reference to Laryngeal Tuberculosis, Am. Rev. Tuberc. **6**:341 (July) 1922.

5. Parfitt, C. D.: The Treatment of Laryngeal Tuberculosis in Sanitaria, Am. Rev. Tuberc. **15**:579 (May) 1927.

son,[6] 25 per cent, of Looper and Schneider,[7] 15.5 per cent, and of Laub, 6 per cent. It need hardly be added that all the patients with tuberculosis of the larynx in this series had pulmonary tuberculosis as well.

TABLE 1.—*Incidence of Laryngeal Tuberculosis According to Racial Classification*

Race	Percentage	Race	Percentage
Japanese	36.0	Puerto Rican	4.0
Filipino	18.3	Samoan	0.5
Hawaiian	17.7	Spanish	0.5
Chinese	7.2	English	0.4
Korean	5.1	Russian	0.3
American	4.5	Other	1.2
Portuguese	4.3		100.0

TABLE 2.—*Incidence of Laryngeal Tuberculosis According to Occupation*

Occupation	Number of Patients	Percentage
Laborers	469	24.5
Housewives	304	15.9
Students	302	15.8
Clerks	121	6.3
Mechanics	61	3.2
Carpenters	33	1.7
Waiters	25	1.3
Nurses	25	1.3
Cooks	22	1.2
Seamen	20	1.0
Miscellaneous	123	6.4
No occupation	409	21.4
Total	1,914	100.0

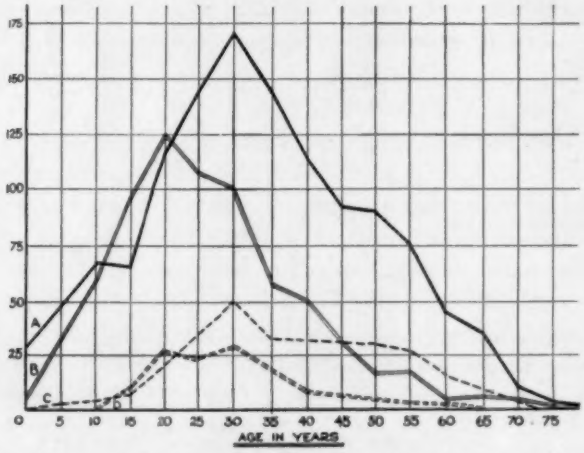
TABLE 3.—*Incidence of Laryngeal Tuberculosis According to Age*

	Male		Female	
Age, Years	Number of Tuberculous Patients	Number of Patients with Tuberculous Laryngitis	Number of Tuberculous Patients	Number of Patients with Tuberculous Laryngitis
Under 6	38	0	29	0
6 to 10	67	3	64	0
11 to 15	65	7	97	10
16 to 20	119	22	125	26
21 to 25	148	37	109	24
26 to 30	171	51	100	27
31 to 35	137	37	55	18
36 to 40	111	34	49	11
41 to 45	89	33	30	9
46 to 50	87	30	17	6
51 to 55	75	26	17	2
56 to 60	47	13	4	3
61 to 65	36	8	5	0
66 to 70	12	3	4	0
71 to 75	3	0	0	0
76 to 80	3	0	1	0
	1,208	304	706	136

6. Thompson, St. Clair: Tuberculosis of the Larynx: Ten Years' Experience in a Sanitarium, London, His Majesty's Stationery Office, 1924, p. 9.

7. Looper, E. A., and Schneider, L. V.: Laryngeal Tuberculosis: A Study of Five Hundred Patients Treated at the Maryland State Sanitarium from 1923 to 1928, J. A. M. A. **91**:1012 (Oct. 6) 1928.

There were 67 cases of tuberculosis in children under 5 years of age; none of them had a laryngeal disease, but of 131 cases in the age group from 6 to 10, there were 3, and of 162 in the age group from 11 to 15 years, 17 with a laryngeal involvement. This seems to indicate that laryngeal complications of tuberculosis are not uncommon under 15 years of age, in spite of the fact that in an analysis of 500 children with tuberculosis under that age MacKenzie [8] found such a complication in only 1 child. The records did not permit an accurate classification of the locale of the disease, as has been so excellently done in the report of Looper and Schneider. In general, however, the figures of this study agreed closely with theirs. In 500 cases analyzed, they found 137 with lesions of the vocal cords and 133 with lesions localized to both



Incidence of laryngeal tuberculosis in male and in female patients. *A* represents the total number of male, *B*, the total number of female tuberculous patients. *C* represents the number of male, and *D*, the number of female patients with tuberculous laryngitis.

vocal cords and arytenoids, while in 112 the interarytenoid sulcus was involved. Other figures, however, disagree notably with these. Thus Bronfin and Markel [4] found epiglottic involvement in 59.5 per cent of their cases, Fetterlof in 59, Dworetzky [9] in 28 and Hastings in 33 per cent. The arytenoids were involved in 55.5 per cent of Bronfin and Markel's, in 56 per cent of Dworetzky's and in 51 per cent of Hastings' cases. All agreed that the earliest pathologic manifestations of tuberculosis in the larynx occur in the interarytenoid sulcus. Lockard found

8. MacKenzie, J. N.: Some Reminiscences, Reflections and Confessions of a Laryngologist, Ann. Otol., Rhin. & Laryng. **25**:61 (March) 1916.

9. Dworetzky, Julius: The Classification of Laryngeal Tuberculosis, Am. Rev. Tuberc. **3**:544 (Nov.) 1919.

77 per cent of the lesions in this location. The ventricular bands were involved in 36 and the true cords in 43 per cent of Bronfin and Markel's cases. The latter also found that a period of several years may occur between the onset of the pulmonary tuberculosis and that of the laryngeal complication, and he quotes the findings of Levy, who, in a series of 654 cases, found that this period averaged seventeen months.

DIAGNOSIS

The diagnostic routine employed in the clinic at which these studies were made doubtless varies little from that employed in other clinics throughout the country. A description of it in some detail, however, may not be amiss.

All the patients entering the sanatorium are made to submit to a thorough laryngeal examination as soon as their condition permits. This is made with a good light and a laryngeal mirror of medium size. A searching inspection is then made with special attention being paid to the epiglottis and its ligaments, the vallecula, ventricular bands, arytenoids, interarytenoid space, aryepiglottic folds and the true cords. When the epiglottis is found to be retroflected, the patient is made to say "A" in order that a better view of the larynx may be obtained. At times it is necessary to pull the epiglottis forward with a probe before a clear view can be obtained. A great aid in making a laryngeal examination, especially when it is desired to see the interarytenoid space and posterior ends of the cords, is to place the patient in the Turk-Killian position, that is, standing with the head bent forward, with the mirror placed high up on the hard palate. In this position, in some cases, it is possible to see the whole posterior portion of the larynx and the upper part of the trachea. Many cases of incipient laryngeal disease are detected in these routine examinations, and my experience corroborates Thompson's [6] statement that, of his 477 cases, not less than 5 per cent had no complaint referable to the throat, and that their voices, both to his ears and to theirs, sounded clear.

PROGNOSIS

The old belief that the laryngeal complication sealed the doom of the tuberculous patient has fortunately had the fate of that other bogey, the Gräff dictum concerning cavities. Modern methods of treating both tuberculosis and its laryngeal manifestations have made it possible to assume a much more optimistic attitude. When one recalls that laryngeal tuberculosis is only a part of a generalized respiratory, or even a more widespread tuberculosis, it is easy to see that amelioration of the part must accompany or follow that of the whole, although this is not necessarily always true. When laryngeal involvement and destruction have reached the stage wherein they constitute in themselves a menace to the

life of the patient, it is obvious that healing of the pulmonary lesion can no longer prevent a fatal ending. It must be insisted, therefore, that the laryngologist who wishes to treat his patients most intelligently and with the lowest percentage of disappointing results must avail himself to the fullest of the information supplied by the internist concerning the status of the patient's respiratory disease. A course of treatment mapped out in accordance with such knowledge will be most fruitful of results gratifying to all concerned.

TREATMENT

In line with this the first principle of treatment should be the immediate establishment of the form of therapy most suited to the needs of the patient's respiratory tuberculosis, and as much as possible along modern lines. It is remarkable, and it has not been sufficiently stressed in the literature, that patients actively and successfully treated by pneumothorax or any other form of collapse therapy show a high percentage of cures of their laryngeal complications. Cooper and Benson [8] reported this phenomenon in 72 per cent of their cases. In a survey of 128 patients treated by pneumothorax in this sanatorium during the past year, only 4 with active laryngeal involvement could be found. Since 33 of these patients had laryngeal tuberculosis before pneumothorax was begun, the figures are somewhat higher than those quoted. The phenomenon is observable in all forms of collapse therapy, as, indeed, in many cases of spontaneous healing of the lung. The phenomenon of laryngeal healing *pari passu* with that of the lung is perhaps best illustrated by the case of a young Chinese boy treated in the institution for bilateral tuberculosis of the upper lobe and tuberculous involvement of the larynx. After three years of treatment the boy walked into the clinic one afternoon and announced in a clear, resonant voice that he had "found his voice again." Previously he had been unable to do more than whisper. Investigation by the laryngologist revealed complete healing, and consultation with the hospital staff brought out the fact that the pulmonary lesion had been in a state of virtual quiescence for about six months, but discharge was being held up by reason of the apparent hopelessness of the laryngeal complication.

A dozen years ago treatment of tuberculosis of the larynx was directed mainly to the relief of symptoms and embraced such measures as topical application of lactic acid in strengths increasing from 3 to 20 per cent aqueous solution, 10 per cent solution of formaldehyde and Lake's pigment.[9a] Spraying with orthoform and cocaine hydrochloride

9a. Lake's pigment is composed of formaldehyde, 7; phenol, 10; lactic acid, 50; water, 33. The formula was given by Charles G. Parfitt (Am. Rev. Tuberc. **15**:582 [May] 1927.)

were, and to a large extent still are, used to relieve pain and facilitate the taking of food.

In 1922 Lukens [10] published his results in the treatment of laryngeal tuberculosis with chaulmoogra oil, which at that time enjoyed a wide vogue in the treatment of leprosy. The effect of chaulmoogra oil on acid-fast organisms in culture was shown by Schobl [11] in 1923 to be a marked retardation of growth.

At that time I employed the oil on a group of patients with open ulcers, using the preparation originated by Dean and Wrenshall [12] in 1922; the results have been reported elsewhere.[13] The oil was applied directly to the ulcer by means of a specially designed syringe with a curved nozzle. The patients so treated had considerable relief from symptoms, but whether this was due to the oil itself or to the iodine added in Dean and Wrenshall's formula is difficult to say. An early article of Dworetsky [14] mentions amelioration of symptoms as a result of the topical application of iodine. The results were deemed insufficient to warrant continued use, however, and this conclusion is in accord with the excellent article of Bronfin and Markel [15] on the subject.

Heliotherapy in tuberculosis has accumulated a voluminous literature of its own. In laryngeal tuberculosis its use dates back to 1903, when Joseph Sorgo used it at Davos. The original method making use of a single concave mirror [16] has been discarded for the ingenious device invented by Frank Verba and first reported by Mills and Forster.[17] I used this arrangement for about three years but discarded it after it appeared obvious that the results, if any, were largely psychologic. In addition it must be emphasized that my patients belong almost entirely to the laboring classes and that such persons had more than the usual difficulty in mastering the technic of the method.

The present treatment makes use of vocal rest as a fundamental regimen for all the patients with laryngeal involvement. I am well aware

10. Lukens, R. M.: Chaulmoogra Oil in Treatment of Tuberculosis of the Larynx, J. A. M. A. **78**:274 (Jan. 28) 1922.

11. Schobl: Philippine J. Sc. **23**:533, 1923.

12. Dean, Arthur L., and Wrenshall, Richard: Pub. Health Rep. **37**:1395 (June 9) 1922.

13. Van Poole, G. M.: Chaulmoogra Oil in the Treatment of Laryngeal Tuberculosis, Laryngoscope **40**:132 (Feb.) 1930.

14. Dworetzky, Julius: The Prognosis and Treatment of Tuberculous Lesions of the Larynx, Am. Rev. Tuberc. **2**:1 (March) 1918.

15. Bronfin, L. D., and Markel, C.: Chaulmoogra Oil in the Treatment of Laryngeal Tuberculosis, Am. Rev. Tuberc. **10**:73 (Nov.) 1923.

16. Voorsanger, William C.: Heliotherapy in the Treatment of Laryngeal Tuberculosis, Am. Rev. Tuberc. **6**:223 (May) 1922.

17. Mills, C. W., and Forster, A. M.: The Treatment of Laryngeal Tuberculosis by Reflected Condensed Sunlight, Am. Rev. Tuberc. **11**:699 (Jan.) 1919.

of the controversy that has raged over this measure, but my own feeling in the matter is that, even if complete rest of the larynx is unattainable, such decreased activity as may be achieved must be of distinct value, and, indeed, it is, if clinical observation has any value as a measuring rod.

Various palliatives are employed for the relief of pain and dysphagia; among those may be mentioned cocaine, hydrochloride, ethyl aminobenzoate lozenges and ice chips. Injection into one or both supralaryngeal nerves, first introduced by Hoffman in 1908, is practiced extensively in cases that are found refractory to the simple analgesics.[18] My method is to insert a fine gage needle about 1 inch (2.54 cm.) external to the midline in the space between the upper border of the thyroid cartilage and the hyoid bone. The needle is pushed in perpendicularly to a depth of 1.5 cm., or until the patient complains of a sharp pain in the ear on that side. At this point, from 1 to 2 cc. of 85 per cent alcohol is injected and the puncture mark sealed with collodion. I have had no experience with the method of crushing or extirpating this nerve, and do not see that it offers any advantages over the relatively simpler procedure.

Electrocautery is by far the most satisfactory treatment in the majority of cases.[19] As Wood and others have pointed out, it owes its beneficial action to the fact that it produces vascularization of the lesion, thus increasing the resistance of the area to further spread of the infection and promoting fibroblastic replacement of the lesion. This method was apparently first used by Voltolini in 1861, and later by Heryng in 1887. Through the work of Mermod, Gruenwald and Harland it gained increasing strength, and at the present time it is preeminently the method of choice in selected cases. In the clinic the cautery is used directly through a Haslinger short one-sided laryngoscope, or indirectly, using a laryngeal mirror. The throat is sprayed with cocaine hydrochloride, and the larynx anesthetized, using a mixture of two parts of epinephrine and one of 20 per cent solution of cocaine hydrochloride, applied with a camel's hair brush. A sharp-pointed cautery is used, brought to red heat and inserted to a depth of 1 cm. into the tuberculous area. The cautery must be removed with the current on full. The cautery treatment is repeated not oftener than every two or three months.

There are certain definite contraindications to the use of electrocautery. These are: rapid progression of the pulmonary lesion, unusually high temperature or any other manifestation of extreme toxicity;

18. Swetlow, G. I.: The Injection of the Superior Laryngeal Nerve with Alcohol for the Relief of Pain in Laryngeal Tuberculosis, Am. Rev. Tuberc. **12**:189 (Nov.) 1925. Raine, F., and Banyai, A. L.: Superior Laryngeal Nerve Block, Am. Rev. Tuberc. **26**:427 (Oct.) 1932.

19. Greene, Joseph B.: The Electrocautery in the Treatment of Laryngeal and Pharyngeal Tuberculosis, Am. Rev. Tuberc. **10**:73 (Sept.) 1924.

lesions of the larynx of the tumor type in which the inflammatory reaction resulting from cautery may seriously impair breathing by blocking the airway; idiosyncrasy to cocaine hydrochloride in the form of unusually rapid pulse and symptoms of shock appearing after the preliminary spraying with the drug.

One should be prepared to meet emergency situations that occasionally arise. One patient in this series, a young girl aged 15, on whom cautery of a lesion lying in the interarytenoid space was attempted, gave a trying experience. The cautery point evidently pushed the tuberculomatous mass into her larynx; this resulted in immediate and dramatic symptoms of suffocation with urgent dyspnea, air hunger and loss of consciousness. An immediate tracheotomy saved the life of the patient.

It may be said, finally, that every possible procedure that gives any promise of either temporary palliation or more permanent results is resorted to. The Wolfenden position is used in some cases to make swallowing easier. The other foci besides those in the lung are systematically sought and eradicated when found. This runs the whole gamut of what the internist usually labels "little things": polyposis of the nose, sinusitis, pharyngitis (specific or otherwise), otitis, mastoiditis and so on *ad infinitum*. It is perhaps partly true that the treatment of the laryngeal complication has not kept pace with the rapid stride of modern surgical treatment of tuberculosis. The difficulties involved are easily adumbrated, however, and need not be enlarged on here. It is hoped, however, that the promise implied in the consideration of the two as expressions of the same disease may bring to the laryngologist a larger proportion of cases amenable and responsive to treatment.

CONCLUSIONS

1. Laryngeal and pulmonary tuberculosis are mutually interdependent manifestations of the same disease.

2. Treatment of the first should be guided by, and run parallel with, the course of the pulmonary disease.

3. Modern and intensive treatment of the disease as a whole is the first and most essential measure.

4. In properly selected cases electrocautery offers the best results in laryngeal tuberculosis.

5. In the cases unsuited for cautery palliation of symptoms must be resorted to in order to assure the patient of the conservation of such chances as he may have for recovering.

6. The laryngologist must work in close cooperation with the internist to obtain the best results.

MODERN SURGERY IN DIPHTHERIA

OBSERVATIONS ON SIX THOUSAND AND ELEVEN CASES

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A review of the literature of the past few years dealing with this subject is disappointing: first, because of the small number of articles written; second, because of the few cases reported in most of the articles, and third, because none has covered all the surgical problems encountered when handling a large number of cases of diphtheria.

Of my series of patients, 5,993 were under my observation and care at the Philadelphia Hospital for Contagious Diseases, at which I was chief resident physician and also resident otolaryngologist. The remainder of the series were admitted to my service more recently at the Park View Hospital, Rocky Mount, N. C. Complete statistical data for the earlier group have not been compiled; however, partial statistics have been obtained.

In all the latter group of patients and approximately one fifth of the former the diphtheritic involvement was of the lower respiratory tract, and therefore required special surgical treatment. The patients came from all walks of life, but the majority were from poor, crowded districts. All the patients with involvement of the upper respiratory tract came from families of the middle and lower classes, and in general had not had the advantages of preventive medicine and surgery, such as proper nourishment, immunization and removal of tonsils and adenoids. In this connection I may appropriately state that I have never seen death from diphtheria in any patient whose tonsils and adenoids had been removed, or who had at some time previously been actively immunized and later proved to have a negative reaction to the Schick test.

The death rate of the Philadelphia group was 8.63 per cent, but after excluding those who were hopelessly ill on admission and who died during the first twenty-four hours in the hospital the death rate was only 5.53 per cent. In the Rocky Mount group, all of whom had laryngeal involvement, there were 3 deaths. Two died within ten minutes after admission, before intervention was possible; intubation and artificial respiration failed to resuscitate them. The other patient died of myocarditis after being in the hospital for four days, the respiratory

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difficulty having been practically relieved. Therefore, of 16 cases of laryngeal involvement in which the patient was actually treated for the obstruction there was only 1 death and that from myocarditis. In the laryngeal cases of the first group the death rate for all patients admitted was approximately 25 per cent, but after excluding those hopelessly ill on admission and dying within twenty-four hours the rate was only 16.4 per cent.

The management of diphtheria presents a threefold problem: first, combating the acute intoxication; second, relieving, in about one sixth of the cases, the mechanical obstruction to the respiratory tract, whether it is pharyngeal, laryngeal, tracheal or bronchial; and third, relieving the patient of infection and from isolation after recovery from the acute disease. The general treatment of diphtheria cannot be considered here, so for the purpose of this article I shall assume that the intoxication is adequately treated and that only the last two problems remain for consideration.

The equipment required for adequate administration of this type of work is:

1. A double set of O'Dwyer intubation tubes. Two sets are necessary, so that when a child is wearing a tube a clean one of the same size may be ready to insert immediately should he cough up the one he is wearing.

2. A set of laryngoscopic and bronchoscopic instruments sufficiently complete to do diagnostic work and to remove various types of foreign bodies, especially the cast of diphtheritic pseudomembrane. My experience has been that many types of foreign bodies, particularly mucous plugs, cause the patient to be admitted to the hospital with the mistaken diagnosis of laryngeal diphtheria. The majority of such patients must be cared for on the spot and later be passively immunized with diphtheria antitoxin if they were exposed to the disease.

3. A tracheotomy set. I prefer the set selected by Jackson and called the Jackson tracheotomy set.

4. A complete set of instruments for the care of the ears, nose and throat. Care of these regions may become necessary during the course of the disease, or foci of infection dangerous to others may need clearing up.

The personnel should consist of both physicians and nurses who are specially trained for this type of work and able to use the instruments just mentioned and who have a general knowledge of the course of diphtheria, for often the general and cardiac condition of the patient must be hastily estimated before making a decision pertaining to surgical intervention.

No surgical condition requires care in a hospital more than this one does. Laryngeal or other respiratory obstructive diphtheria is an emergency of the first order, which too often results fatally when treated too late or improperly. If a community hospital is not available the next best plan is to establish a fully equipped miniature hospital for care of the condition in the home. Fortunately, most communities are seeing the need of a small hospital, or a special unit of a general hospital, equipped to care for cases of diphtheria, and it is hoped that the time will soon arrive when every child stricken with this disease will have access to a hospital and to every other facility which aids in recovery. At the Park View Hospital in Rocky Mount, two small rooms have been set apart from the general hospital on the ground floor with a separate outside entrance and are specially equipped for handling these cases.

The most proximal type of obstruction to the respiratory tract encountered in diphtheria is that of the oropharynx and hypopharynx. It begins with involvement of the tonsils, which is perhaps untreated for three or four days while the membrane is spreading over the fauces and pharynx. Sufficient cervical edema and swelling rapidly appear to cause complete obstruction of the lower part of the pharynx and the so-called "bull neck." In my series a bull neck did not occur in any case in which the tonsils and adenoids had been removed. Approximately 10 per cent of cases at the Philadelphia Hospital were of this type, but only a small percentage showed complete obstruction. It was unusual for the larynx and lower respiratory tract to be involved at the same time; however, it occurred rarely as a mild extension in the larynx and trachea. A case of complete obstruction of the pharynx and larynx at the same time was not seen. It is obvious that there is only one means of real relief for these patients and that is an orderly tracheotomy. I have performed several in cases of this kind—once while an assistant made an airway between two fingers inserted through the pharyngeal obstruction to permit breathing until the tracheotomy tube was in place. I have also done tracheotomies while assistants held a laryngoscope or bronchoscope through the pharynx for the same purpose. Most of these patients died of acute toxemia. One patient survived the acute toxemia, the tube was removed, and the wound healed in ten days; then, during the fifth week of convalescence a heart block developed, a condition which in diphtheria is always fatal. None of the patients with obstruction of the lower part of the pharynx requiring a tracheotomy completely recovered. They usually died of myocarditis.

The next type of obstruction dealt with was that of the larynx, trachea and bronchi. After preliminary inspection of the mouth, throat and nose, routine inspection of the larynx is done by direct laryngoscopy in every case exhibiting a croupy cough or any degree of labored

respiration. A Jackson anterior commissure laryngoscope, usually a no. 12, but sometimes a no. 17, is used. In every case of diphtheritic involvement an inflamed and sometimes a swollen laryngeal mucosa is seen unless it is covered by pseudomembrane and the view obstructed. Pseudomembrane is not always present in the pharynx, but it is usually seen at the laryngeal orifice overlying the aryteno-epiglottic folds and extending down into the larynx and over the vocal cords. This is removed by using a blunt tracheal or bronchial aspirating tube through the laryngoscope. Contrary to the popular idea, removal of this membrane does not leave a bleeding mucosa. Slight oozing sometimes occurs when membrane is peeled from the tonsils, but that is because they are much more vascular than the larynx and trachea. The aspirating tube is then inserted gently down through the larynx into the trachea and also into the bronchi if necessary and aspiration continued until no membrane is obtained. A bronchoscope should not be passed in a case of this kind; a blunt 20 to 40 cm. aspirating tube used through an anterior commissure laryngoscope is much better because: 1. The bronchoscope is of much larger caliber than the aspirating tube and consequently there is more danger of traumatizing the inflamed laryngeal mucosa. 2. The usual postbronchoscopic laryngeal edema would be a serious consequence in these cases, whereas there is no such reaction from the use of the aspirating tube through the laryngoscope. 3. The pseudomembrane can be removed from the larynx, trachea and large bronchi just as well and possibly better with the blunt aspirating tube alone than when it is used through a bronchoscope. 4. The use of the aspirating tube is much quicker, and therefore greatly lessens the fatigue to the patient. This is a most important consideration.

The membrane was usually aspirated in the form of broken laryngeal, tracheal or bronchial casts, but many times I have aspirated in one piece a cast of the trachea with several divisions of the bronchial tree intact. Occasionally there was no membrane in the pharynx or larynx, but almost a complete cast of the trachea and bronchi. In these cases there was no hoarseness or croupy cough, but otherwise the picture was the same as with laryngeal involvement.

After thoroughly aspirating the membrane from the larynx, trachea and bronchi approximately 95 per cent of patients (depending on the stage of the disease) breathe easily, improve in color, take nourishment and often go to sleep. However, after the membrane has been cleaned out of the larynx the remaining inflammation of the laryngeal mucosa narrows its lumen, and this sometimes requires immediate intubation after aspirating the membrane; but as a rule these cases occur in babies under 2 years of age, and present a real emergency before aspiration is done.

Pseudomembrane may, and often does, reform in from six to twelve hours, during the first twenty-four to thirty-six hours after starting

treatment, and in a sufficient amount to require reaspirating. I have had to repeat this procedure several times over periods of three or four days. If the lumen of the larynx can be kept open and the dyspnea relieved by this procedure it should be used as often as is necessary, thus eliminating the insertion of the O'Dwyer tube and its dangers. Although intubation is necessary at times, and saves life in many cases, a résumé of the dangers and results is sufficient argument that it is an undesirable procedure. The dangers are:

1. In a child who has had intubation done an emergency is always likely to occur, for the tube may be coughed up at any time, leaving the larynx in spasmodic stenosis and requiring immediate reinsertion of the tube to prevent sudden death from asphyxiation.

2. When intubation is done without first cleaning the membrane from the larynx the membrane may be pushed down in front of or into the tube, thus blocking the lumen. Also, when the membrane has not been cleaned from the trachea and large bronchi before intubation, the cast may break away and be coughed against the distal end of the tube, blocking the opening. Either causes an emergency requiring immediate extubation, clearing of the larynx and trachea and possibly reintubation with a clean tube.

3. Intubation, when done by the most skilful operators, sometimes traumatizes the inflamed laryngeal mucosa. This almost always happens when intubation is done by beginners. The traumatized area, depending somewhat on its extent and the resistance of the patient, may heal primarily without infection, or it may become infected and form an ulcer. When once an ulcer forms, such a larynx almost always becomes spasmodic when the tube is removed, often to the extent of producing complete stenosis requiring immediate reintubation and subsequent treatment of a "chronic tube case."

4. Even when a perfect intubation has been performed without trauma, and the tube has been left in for a few days, it always acts as a foreign body to the larynx and ulceration may form about it. This rarely happens, but when it does, there is a potential "chronic tube case" to deal with. And even in the "chronic tube case" after the patient is freed from the tube there is always a certain amount of cicatricial stenosis resulting, which may or may not completely clear up.

5. When intubation causes ulceration and secondary infection in the larynx it greatly increases the possibility and danger of secondary bronchitis and bronchopneumonia.

Intubation should never be done until after laryngoscopy and aspiration; then, if it becomes necessary, the larynx and the trachea have already been cleaned and are better prepared to receive and retain the tube. Used in this way intubation at last finds its proper place and

relieves perfectly the condition it was conceived to relieve. Also, when used in this way, fully 80 per cent of the dangers of its use are eliminated. The late Dr. S. S. Woody, head of the Philadelphia Hospital for Contagious Diseases for twenty-five years, told me that since the introduction of laryngoscopy and aspiration, in 1924, not only has the mortality been greatly reduced, but there has been a great reduction in the percentage of laryngeal cases requiring intubation, in the number of "chronic tube cases" and in the number requiring tracheotomy. In cases of dire emergency, when laryngoscopy and aspiration are not available, intubation may be done as a life-saving procedure; but even then the tube should be removed as soon as possible, and the larynx and trachea freed of membrane. After this is done reinsertion of the tube is often unnecessary.

Intubation may be performed by the direct or the indirect method. In the direct method the tube is inserted into the larynx through a laryngoscope by the use of a straight obturator. In the indirect method the tube is inserted into the larynx by touch; the indirect obturator is used to direct the tube to the larynx and then the left forefinger guides it into the larynx. I have used both methods, but in the ordinary case of acute obstruction the indirect method is by far the better, because in 98 per cent of cases it is not possible to determine accurately the necessity for intubation following laryngoscopy and aspiration until after the laryngoscope is withdrawn and the child is at rest. Then, if intubation is necessary it is much quicker and simpler to do it indirectly than to pass the laryngoscope again. An experienced operator can do it as efficiently by one method as by the other; therefore the simpler and quicker one should be chosen. Possibly a novice would cause less trauma with the direct method.

I use no. 4 banjo wire securely attached in the hole in the shoulder of the tube. After the tube is inserted into the larynx the wire is cut, so as to leave the ends free in the roof of the mouth, making it impossible for the child to work the tube out with his tongue. Also, this makes it easy to perform extubation quickly. Splints are put on the child's elbows, so that it is impossible for him to take out the tube with his hands.

The tube is ordinarily left in the larynx for five days, after which it is removed and left out if possible. In selecting a day for extubation the weather should be considered. If possible it should be a bright sunny morning, for it has been proved by experience that children from whom the tube has been removed on a damp rainy day more often require reintubation.

One type of diphtheria of the lower respiratory tract is always fatal, since no procedure has been devised to relieve it. It is diphtheria of the lower alveoli of the lungs, and is termed diphtheritic bronchopneumonia.

It is usually associated with tracheobronchial diphtheria, but I have seen it occur independent of involvement of the larynx, trachea and upper bronchi. As soon as the membrane begins to soften and liquefy the terminal bronchioles become obstructed with fluid and the child soon suffocates. The diagnosis in these cases was easily proved at autopsy by macroscopic, microscopic and bacteriologic examinations.

The relief of "chronic tube cases" has been a serious problem since the invention of the O'Dwyer tubes. However, it is not the problem it was before laryngoscopy and aspiration began to be used. Before that time there was a special building containing twenty beds at the Philadelphia Hospital for Contagious Diseases to care for such cases and for resulting cases requiring tracheotomy. But with the introduction of laryngoscopy and aspiration there are few obstinate chronic cases. It is safe to say that this procedure alone has eliminated the vast majority of these cases. The condition to be relieved was one of cicatricial stenosis, either of a small portion of the larynx or of the whole of it.

The method of relieving these patients is, first, to try to insert a tube one or two sizes larger in diameter than the original tube but of the same length. Usually the patient can retain this tube for from two to four weeks without an elevation of temperature. Then it can be removed without producing spasmodic stenosis sufficient to require its reinsertion. Only hard rubber tubes are used because they are much lighter and cause less reaction of the tissue. When the tube can be kept out by this method for two days, nature and normal use of the larynx will complete the recovery. When this method fails to give results early, low tracheotomy should be resorted to without further delay. Then the laryngeal tube is removed and the patient is soon made to breathe through the larynx by gradually plugging the tracheotomy tube. As soon as it has been completely plugged for three or four days and the patient is doing well, the tracheotomy tube is removed and the wound closed. Approximately 40 patients of this type were treated in my series at the Philadelphia Hospital for Contagious Diseases, and if my memory is correct only 7 required tracheotomy. All the patients in this group completely recovered and none were sent to the Jackson Clinic as had commonly been the case previously. The main points in treatment are careful daily observation and occasional laryngoscopic inspection so as to know the condition of the larynx and to prevent it from being too badly damaged before a tracheotomy is done, with removal of the foreign body (laryngeal tube), which will give the larynx a complete rest and nature a chance to heal the tissue.

Thirty years ago many tracheotomies were done to relieve respiratory obstruction in diphtheria, but improvements in relieving the condition have been made until now a tracheotomy is seldom necessary. Only two conditions remain that necessitate a tracheotomy: the pharyngeal

obstruction caused by excessive cervical edema, and the few "chronic tube cases" that require it. It is not often done for the relief of acute laryngeal diphtheria; but it is sometimes the safest procedure for a patient who must remain at home or far out in the country or who is far away from one trained in laryngoscopy and aspiration and in intubation. An orderly low tracheotomy is much safer than intubation without preliminary laryngoscopy and aspiration, and far better and safer than leaving the intubated patient unprotected at home. Emergency tracheotomies in small children are considered dangerous by those who have had experience in doing them, and should be prevented if possible. They may be avoided in cases of laryngeal obstruction if the operator has any kind of laryngeal tube that may be temporarily inserted, and in cases of pharyngeal obstruction if the operator has a laryngoscope, bronchoscope or similar tube that may be used temporarily to force an opening through the pharynx until an orderly tracheotomy is done. In an orderly tracheotomy the child is placed on a table with the neck stretched over a sandbag. Infiltration anesthesia with a 0.5 per cent solution of procaine hydrochloride is used. A long incision of the skin is made in the midline from the superior border of the thyroid cartilage to the suprasternal notch, and the tissues are carefully dissected down to the trachea. All bleeding or oozing should be stopped immediately as it occurs. The upper four rings of the trachea are exposed, and the second and third, and the fourth if necessary, are opened. The first is never cut because it is the only complete one, all the others being deficient in cartilage posteriorly. If the first ring is cut the ends may override each other and greatly lessen the lumen of the trachea or even obstruct it. After the tracheotomy is finished the child is put to bed face downward with one shoulder elevated on a pillow and with the foot of the bed elevated so that any secretions or oozing blood may have dependent drainage. Closing of the tracheotomy wound is done gradually from within outward. Gauze is lightly packed on each side of the trachea to push the severed rings in approximation and to cause them to heal first. Then the remainder of the wound is allowed to heal.

Abscess of the lung is an infrequent sequel to diphtheria of the lower respiratory tract, only 2 cases being observed in my series. One was a girl of 10 years, who had extensive diphtheritic involvement of the throat and lower respiratory tract. Laryngoscopy and aspiration were done several times during the first four days in the hospital before the larynx remained free from pseudomembrane. Then during the third week of convalescence a small abscess was found in the lower lobe of the right lung. It was treated seven times by postural drainage and by bronchoscopic aspiration. The abscess soon cleared up and the child was discharged to the care of her family physician. The other abscess was in a boy of 13 who had a similar diphtheritic involvement. An

abscess in the lower lobe of the right lung developed during the third week of convalescence, but cleared up after three bronchoscopic aspirations. Intubation was not done in either case. The diphtheria bacillus could not be recovered from aspirated pus, although staphylococci were obtained in pure culture. Possibly many other minute abscesses developed on the lungs and cleared up spontaneously.

Abscess of the middle ear is a common condition accompanying diphtheria, especially when the larynx is concerned. It cannot be termed a complication because the diphtheria bacillus was never recovered from the first discharge obtained, but in a few days it was commonly found as a secondary infection. The abscesses were usually mild, and healed in a few days, but in 3 cases a simple mastoidectomy was required before recovery.

Often after a patient has completely recovered from the acute disease diphtheria bacilli linger in the nose, throat, sinuses or ears. Although these persons are well, they can infect others and are a menace to society; therefore they must be isolated until free from the germs. Isolation is good for the protection of those on the outside, but it is hard on the person isolated, for in the past the period of isolation has varied from weeks to two years or more.

Many barrels of germicidal solutions have been dropped in ears and nostrils and swabbed in throats; but it might as well have been poured in the sewer, for it killed only the germs on the surface and never touched the main foci of infection in the crypts of the tonsils and inside the sinuses and ears.

In Philadelphia the law required for release from quarantine the obtaining of two successive negative cultures from both the nose and throat and also from any abnormal discharge. Once, for experimental purposes I took a third culture in 100 successive cases after the two successive negative cultures required for discharge had been obtained. In 63 the third culture was positive; therefore the logical conclusion would be that the law should require the removal or recovery of any apparent harbor of the bacillus.

The principle followed in relieving the patients was extirpation of the focus of infection when possible, and adequately opening for drainage the foci that could not be extirpated. It is not radical to say that the tonsils and adenoids should be removed as a routine in every case after recovery from the acute disease; for even though no bacilli are found by a culture from the nose and throat, they are usually present in the crypts of the tonsils and adenoids. Also, the tonsils and adenoids have been affected beyond repair by the diphtheria bacillus and the mixed infection which always accompanies it, and should be removed. I have removed hundreds when permission for operation could be obtained, and I advised it for the rest.

When positive cultures are obtained from the nose the nasal mucosa should be kept reduced by a spray of 2 per cent aqueous solution of ephedrine sulphate or ephedrine hydrochloride, so that free ventilation and drainage are not obstructed. Also, the nostrils should be irrigated once or twice a day with a Lore nasal irrigator, using physiologic solution of sodium chloride. If positive cultures persist after a week or ten days of treatment it should be assumed that the foci of infection are in the accessory nasal sinuses. Inspection of the nasal passages and transillumination will usually indicate the infected sinus, but often roentgenograms and even direct irrigation of the sinuses are necessary to make the diagnosis. An intranasal operation to permit drainage should be performed. After all foci of infection are removed or drained it is well to use germicidal solutions in the nose and throat and for direct irrigation of the sinuses. When pus draining from an ear gives a positive culture for diphtheria bacilli a secondary infection is always present. The treatment is that ordinarily indicated in the absence of diphtheria bacilli. However, the assumption is made that no discharge should be allowed to flow for more than three to six weeks without surgical intervention. When possible only a simple mastoidectomy should be done, but in chronic cases a radical mastoidectomy may be necessary.

In the light of my experience it behooves all physicians to advocate active immunization against diphtheria.

CONSERVATIVE TREATMENT OF PETROSITIS

REPORT OF TWO CASES WITH RECOVERY WITHOUT OPERATION

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Otologists have finally subscribed to the view that petrositis or suppuration of the petrous pyramid is a more or less definite, clinical, otologic entity. Controversy still exists, and justly so, as to the type of operation to be employed in reaching the suppurative focus. Nor is it universally agreed that in all cases in which a definite diagnosis has been made operative intervention at once becomes imperative.

It must seem obvious that the purpose of any operation on the pyramid should have as its basic therapeutic aim the complete eradication of the diseased tissue or the establishment of adequate drainage from the infected region.

Almour did not pretend that his ingenious operation would effect the complete eradication of the diseased tissue. His efforts were directed solely toward creating an outlet through which the pus from the diseased apex might be evacuated. There is no doubt that the method accomplishes this in no small measure, but there are difficulties to be reckoned with in the performance of the operation. To begin with, in the preparation of the operative field, a radical operation on the mastoid must be performed. With this preliminary procedure the hearing of the ear in which the operation is performed is destroyed. As in all radical operations on the mastoid, the possibility of injury to the facial nerve or the labyrinth is a cause for concern even in the hands of the most skilled operators. Then again, the operative field is confined to a limited area because of the encroachment on it by the surrounding vital and important structures. The burr can therefore create only a small channel, through which it is hoped adequate drainage will be accomplished. There is no doubt that in many instances this newly formed avenue fulfils the aim and purpose of the operator. However, in certain instances free drainage may become impeded by the presence of granulation tissue, which is usually an accompaniment of prolonged bony disintegration. No attempt is made, nor can one be made, to remove the granulations, owing to the fact that the operative field is too small to permit undue manipulation. Sooner or later the granulations may offer serious obstruction to free drainage from the diseased apex.

One of the cardinal diagnostic findings in petrositis is a profusely discharging middle ear. It is well understood that the discharge does

not originate in the tympanum but comes through the latter from the cells situated in the petrous pyramid. In view of this fact one should regard the presence of a profusely discharging ear in a case of petrositis as a most favorable therapeutic phenomenon. There is no doubt that Almour's operation further enhances the drainage by offering an additional point of exit for the suppurative elements from the diseased tip.

One is therefore justified in raising the question as to whether or not this preformed channel through the tympanum, spontaneously created, may not in some instances be sufficient to accomplish a cure without operative intervention. If such is the case, in patients in whom the aural discharge is so profuse and in whom the symptoms are such that invasion of the intracranial structures does not appear imminent it may be advisable to postpone operation, for a time at least, in the hope that a spontaneous cure will result. That spontaneous cure does take place should appear logical enough in view of the fact that the vast majority of patients with the so-called Gradenigo syndrome recover without operation. Etiologically the two conditions are identical. Anatomically they both represent involvement along certain groups of cells leading to the region of the apex of the petrous pyramid. Pathologically, however, petrositis represents a more advanced, a more widespread and a more prolonged process. It has a tendency to involve the deeper cellular structures rather than the superficial. In some instances patients with the Gradenigo syndrome may even recover without an operation on the mastoid. I have known of two such instances. All of the drainage evidently must have taken place in these cases by way of the tympanum. Hence it is reasonable to expect that a similar termination may be effected in the cases of petrositis in which the aural discharge is profuse. In many instances there is no reason why the drainage from this route may not be sufficient to cause spontaneous resolution.

I came to this conclusion as the result of an experience, during the spring of 1933, with two patients who had petrositis and in whom no operation was performed because of the profuse aural discharge. Both patients recovered.

I wish to state, however, that I do not include in this category any cases in which the discharge was scanty or in which the process in the middle ear was resolved.

REPORT OF CASES

CASE 1.—R. H., a girl, aged 8 years, was admitted to my service at the Beth Moses Hospital on March 22, 1933, with the diagnosis of an acute surgical condition of the mastoid.

History.—The previous history was irrelevant. One month prior to admission to the hospital the patient suffered a severe attack of grip. One week later she experienced severe pain in the left ear. A paracentesis was performed, and the patient was relieved of her pain for a period of two weeks. The otorrhea increased during the third week, the pain returned, and the temperature began to fluctuate. At the time of admission there were exquisite tenderness of the mastoid, sagging of the posterosuperior wall of the canal and marked impairment of hearing. Roentgenograms disclosed an extensively pneumatic mastoid with definite evidence of disintegration of the bone.

Mastoidectomy.—The operation, performed on March 22, revealed a broad, deep cellular mastoid with pneumatization in all directions. The zygoma reached unusually far forward. The tip contained free pus. The retrofacial group of cells was pronounced and seemed to extend into the depths of the mastoid process. There were diseased cells in the squama and behind the sinus. The dura and sinus, which were plainly visualized in the plates, appeared to be normal.

The postoperative course was uneventful except for the persistence of a low grade fever ranging from 98 to 101 F. Urinalysis gave negative results. The wound of the mastoid appeared to be clean, and the middle ear was dry. On the fourth and fifth days the patient complained of severe pain over the left eye. The pain appeared in the early afternoon and lasted for several hours. On the sixth day it did not recur and was dismissed as of no importance at the time.

On the tenth day the patient was discharged from the hospital. Owing to the desire of the parents to have the child at home, I permitted her to leave, even though the temperature had not reached normal. At home she had no complaints excepting the low grade fever. She was kept in bed most of the time and brought to the office for dressings. Nothing unusual occurred on the following five days. During this period the temperature in the evenings rose to 101 F. or more. Urinalysis persistently gave negative results. The wound in the mastoid was healing, and the condition of the middle ear seemed to be resolving.

On April 6, fifteen days after the operation on the mastoid, the patient awoke in the early hours of the morning complaining of severe pain in the ear and in the left side of the head. The temperature rose to 102.4 F. I saw her on this morning and on examination found no neurologic signs. The patient did not vomit, and she was fairly comfortable.

From April 6 to April 9 the condition remained unchanged. The paroxysms of pain appeared regularly. They came on shortly after lunch and lasted through the afternoon. They were definitely localized over and behind the left eye.

On April 10, nineteen days after the operation on the mastoid, the left ear began to discharge. On removal of the dressing from the mastoid the entire auricle and that side of the head were covered with purulent exudate that fairly poured from the tympanum. Nevertheless, with the establishment of drainage, the pain did not abate. The otoscopic picture was that of an unresolved otitis.

From April 10 to April 24 the patient's condition remained unchanged except for the paroxysms of pain, which were more frequent, occurring as often as three and four times a day. They were especially severe at night. During this entire period the temperature fluctuated between 98 and 102 F. At no time was there nuchal rigidity or other neurologic signs. Between the paroxysms the child seemed well. Her appetite was fairly good, and she showed no loss of weight. The wound in the mastoid was clean, but the middle ear discharged profusely. I permitted the canal to be exposed so that frequent cleansing was possible.

Repeated examination of the eyegrounds failed to disclose any abnormalities. The function of the external rectus on that side remained unimpaired.

April 25 (thirty-four days after the operation on the mastoid and nineteen days after the appearance of symptoms suggestive of petrositis) seemed to be the turning point in the patient's condition. This was the first night during which the pain failed to appear. On the successive days the paroxysms of pain seemed to be less intense. The temperature curve became lower, so that in the evening it reached only 100 or 100.5 F. The ear, however, continued to discharge profusely.

From April 28 to May 9 there was gradual recession of all of the symptoms. The paroxysms of pain ceased during the night and were fewer and milder during the day. The patient no longer required sedatives. The wound of the mastoid was completely healed.

On May 26 the middle ear was dry and resolved. The patient's hearing was normal, and she was discharged as cured sixty-three days after the original operation on the mastoid.

Case 2.—M. S., a girl, aged 6 years, was admitted to the Beth Moses Hospital on April 13, 1933, with the diagnosis of an acute condition of the left mastoid which required surgical intervention.

History.—The previous history was irrelevant. Four and a half weeks prior to admission to the hospital the patient had a cold in the head. Four days later the temperature rose. The patient complained of pain in the ears. The urine showed many pus cells in clumps, and the temperature was therefore attributed to the pyelitis. The examination of the ears, according to the mother, gave negative results. The high temperature persisted, although the urine became clear. Again the patient complained of pain in the left ear. I saw her for the first time on the twenty-second day of this illness. I found a bulging drum and tenderness of the mastoid. The former was incised, and free pus welled up into the canal. Following the paracentesis, the pain seemed to abate a little, but the temperature fluctuated, reaching 103 and 104 F. in the evenings. After eleven days of otorrhea the canal showed narrowing, and I advised an operation.

Roentgen examination on the day of admission disclosed a large pneumatic mastoid, with definite evidence of softening of the bone.

Mastoidectomy.—The operation, performed on April 4, 1933, showed that the mastoid was broad and deep, and that the cells were large and widely distributed. Pus was found in the tip, the periantral cells and the cells behind the sinus. The zygoma was extensive and showed marked destruction. Small areas of the sinus and the dura were accidentally exposed. They appeared to be normal.

The postoperative course was uneventful. On the day after operation the temperature reached 105 F. On the following morning it dropped to 102 F., and on the third day it reached normal. On the fourth day the sutures were removed. The wound in the mastoid was clean, but the middle ear continued to discharge. On the fifth and sixth days the temperature rose to 101 and 100.4 F., respectively. The urine was normal. The patient had no complaints, and although her temperature on the sixth day was 100.4 F., I discharged her from the hospital. She was apparently well and on the road to an uneventful convalescence.

From April 20 to May 2 she came to my office on alternate days for dressings. She seemed to be recovering. Her temperature remained low during the day but rose each evening to 101 F. and slightly over. Her appetite, however, was poor. Urinalysis revealed pus cells and a slight trace of albumin. The wound of the mastoid was granulating, and the middle ear continued to discharge slightly.

On May 3 the patient spent a restless night. The next morning she vomited her breakfast. Her temperature rose to 103 F. She complained of headache in the left frontal region and pain in the left cheek and the upper teeth. At this time

there was absence of neurologic signs. The eyegrounds were normal. The mastoid wound was clean, but there was a definite increase in the aural discharge.

From May 5 to May 17 the course of the infection was rather indefinite. There were days when she seemed apparently well, and others when she complained. At no time, however, was she afebrile. The temperature varied. On some days the maximum temperature was 100 F., and on others it rose to 103 F. The headaches varied. On some days they were absent, on others they were mild, and on still others they were intense. In general, the patient was always restless during the night. She ate poorly and seemed to lose weight. Repeated neurologic examinations failed to reveal anything abnormal. The eyegrounds likewise showed no pathologic changes. The wound of the mastoid was healing, and the discharge from the middle ear became scant.

The period from May 18 to June 1, like the preceding period, was one of low grade sepsis. The temperature, however, now seemed to have daily remissions. It varied from 98 to 101 and 102 F. The pains likewise began to grow progressively worse. At night they were especially severe. Relief was obtained by the administration of codeine. The pains were typically located in and above the left eye. At times they radiated to the left temple and the teeth; occasionally, when the pains were intense, the patient vomited.

Again the middle ear discharged profusely. The otoscopic picture was that of resolved otitis. Hearing was moderately impaired.

During the interval from June 2 to June 9 the symptoms continued with little change. As a matter of fact, the pains grew more intense, and the discharge became more profuse. But there was no generalized headache, persistent vomiting or neurologic signs. The temperature curve was somewhat lower, never going above 101 F. On June 6 the child was seen in consultation with Dr. Friesner. He concurred in the diagnosis. Owing to the fact that the middle ear was discharging profusely, he also advised operative intervention.

On June 10, fifty-eight days after operation on the mastoid, the patient complained of double vision. Examination disclosed paralysis of the left external rectus muscle.

From June 11 to June 18 the paroxysms of pains, the aural discharge, the external rectus palsy and the high temperature continued unabated. No neurologic signs were in evidence. The eyegrounds were normal.

On June 19, sixty-seven days after the operation on the mastoid, the temperature reached 103 F., and the patient complained of torticollis and pain on swallowing. I did not see her until the next morning, June 20. Examination at this time revealed a large, painful, fluctuating mass in the retropharynx on the left side. A diagnosis of retropharyngeal abscess was made, and the mass was incised. I obtained an enormous quantity of thick, greenish pus. Relief followed immediately.

On June 21, the child's condition was greatly improved. For the first time in many nights, she slept through the night. The temperature did not rise above 100 F., and the following day, although the pain in the eye was present, it was much less severe.

From June 23 to July 1 all of the symptoms abated. The aural discharge became scanty, and the paroxysms of pain ceased. The temperature reached a normal level and practically remained there. By the end of the week the patient's appetite improved, and she seemed well on the road to recovery.

On July 10, the middle ear was dry and resolved, with return of all of the landmarks. There was marked improvement of hearing, whispered voice being

heard at a distance of 10 feet (3 meters). Movement of the external rectus also showed signs of recovery; the eye could be drawn well beyond the median position.

On July 22, function of the external rectus had completely returned. The middle ear was dry, and hearing was practically normal. The patient's general condition was excellent; she had gained 11 pounds (4,989.51 Gm.) in two weeks. I discharged her as cured on this date, which was one hundred days from the date of the original operation on the mastoid.

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USE OF EXTRACT OF THE SUPRARENAL CORTEX IN PYOGENIC INFECTIONS

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The suprarenal gland is a composite structure consisting of two entirely distinct systems of tissue that differ both phylogenetically and ontogenetically. In the selachians the medulla and cortex are separate glands, the latter appearing as the interrenal body. In the higher vertebrates the cortex develops from the celomic epithelium near the germinal ridge and comes to lie between the wolffian body and the aorta. The medulla is derived from the cells of the ganglionic germ layer of the sympathetic nervous system that wander into the folds of the cortical substance.

Morphologically and embryologically the cortex and medulla differ widely, and it was apparent to many investigators that they must differ as widely in function. By removing the interrenal body from members of the order Selachii (shark and skates), Biedl [1] was the first to demonstrate that the cortical substance is essential to life. Wheeler and Vincent,[2] Houssay and Lewis,[3] Wislocki and Crowe [4] and Zwemer [5] showed that the complete destruction of the medulla of the suprarenals of rabbits, cats and dogs by cautery or curettage was attended by no ill effects; removal of the surviving cortical tissue resulted in death.

Many studies on the chemical changes in the blood of suprarenalectomized animals and of patients with Addison's disease before and after the administration of potent extracts of the suprarenal cortex have led

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From the Oscar Johnson Institute, Department of Otolaryngology, Washington University.

1. Biedl, A.: Innere Sekretion, ed. 2, Berlin, Urban & Schwarzenberg, 1913.

2. Wheeler, T. D., and Vincent, S.: The Question as to the Relative Importance to Life of Cortex and Medulla of the Adrenal Bodies, Tr. Roy. Soc. Canada **11**:125, 1917.

3. Houssay, B. A., and Lewis, J. T.: The Relative Importance to Life of Cortex and Medulla of the Adrenal Glands, Am. J. Physiol. **64**:512, 1923.

4. Wislocki, G. B., and Crowe, S. J.: Experimental Observations on the Adrenals and the Chromaffin System, Bull. Johns Hopkins Hosp. **35**:187, 1924.

5. Zwemer, R. L.: An Experimental Study of the Adrenal Cortex, Am. J. Physiol. **79**:641 and 658, 1927.

to a number of theories regarding the specific function of the cortex. With the onset of symptoms of suprarenal insufficiency there occur increases in nonprotein nitrogen, urea, inorganic phosphates and sulphates and decreases in sugar, bicarbonates, chlorides and sodium (Swingle,[6] Yonkman,[7] Swingle and Wenner,[8] Loeb, Atchley, Benedict and Leland [9]). According to Britton and Silvette,[10] the prepotent function of the cortex is the regulation of carbohydrate metabolism. They found that in the liver and muscles glycogen is more greatly depleted after the removal of the suprarenal glands than in severe inanition, exhaustion or exposure to cold. Loeb and his associates have placed a great deal of stress on the loss of sodium in the urine. The loss of chloride follows that of sodium but is not equivalent. Cortical extract brings about a return of the plasma constituents to normal levels. The recovery is accelerated by the concomitant parenteral administration of sodium chloride and dextrose (Harrop, Soffer, Ellsworth and Trescher [11]), which given alone are ineffective. In insufficiency the basal metabolic rate is decreased from 20 to 25 per cent in dogs. In suprarenalectomized dogs receiving extract the basal metabolic rate is normal. The consumption of oxygen of normal dogs receiving large amounts of extract is not changed (Harrop, Weinstein, Soffer and Trescher [12]). No phenomena of overdosage have been observed with extract of suprarenal cortex (Harrop and Weinstein [13]).

Dehydration is an important factor in the symptomatology of suprarenal insufficiency. The rapid loss of the weight, the decreased elasticity of the skin, the dryness of the serous and mucous membranes and the

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6. Swingle, W. W.: Studies on the Functional Significance of the Suprarenal Cortex, Am. J. Physiol. **79**:666, 1927.

7. Yonkman, F. F.: Acid Intoxication of Adrenal Insufficiency in Dogs, Am. J. Physiol. **86**:471, 1928.

8. Swingle, W. W., and Wenner, W. F.: Sulphate Retention in Dogs Following Bilateral Adrenal Extirpation, Physiol. Zool. **1**:37, 1928.

9. Loeb, R. F.; Atchley, D. W.; Benedict, E. M., and Leland, J.: Electrolyte Balance Studies in Adrenalectomized Dogs with Particular Reference to Excretion of Sodium, J. Exper. Med. **57**:775, 1933.

10. Britton, S. W., and Silvette, H.: Apparent Prepotent Function of Adrenal Glands, Am. J. Physiol. **100**:701, 1932.

11. Harrop, G. A.; Soffer, L. J.; Ellsworth, R., and Trescher, J. H.: Plasma Electrolytes and Electrolyte Excretion During Suprarenal Insufficiency in the Dog, J. Exper. Med. **58**:17, 1933.

12. Harrop, G. A.; Weinstein, A.; Soffer, L. J., and Trescher, J. H.: Metabolism, Circulation and Blood Concentration During Suprarenal Insufficiency in the Dog, J. Exper. Med. **58**:1, 1933.

13. Harrop, G. A., and Weinstein, A.: Studies on the Suprarenal Cortex: I. Cortical Suprarenal Insufficiency and the Action of the Cortical Hormone upon the Normal and Suprarenalectomized Dog, J. Exper. Med. **57**:305, 1933.

hemoconcentration with decreased peripheral circulation are due to the loss of water. The changes in the chemistry of the blood in experimental suprarenal insufficiency and in dehydration resulting from nutritional disturbances in infants are similar (Sullivan, MacLean and Zwemer [14]). Dehydration with acidosis or alkalosis occurs with the loss of water and fixed bases or chlorides in the stool or vomitus. Hemoconcentration impairs renal function, producing a retention of nitrogen. Extract of suprarenal cortex increases the affinity of the blood and tissues for water and thus restores a normal water balance.

Studies on the pathology of the suprarenal cortex in relation to infections date back to Roux and Yersin,[15] who first observed changes in the cortex in bacterial intoxication. They reported a marked hyperemia of the cortex of rabbits and guinea-pigs following the administration of diphtheria toxin. In experimental and clinical studies Behring,[16] Oppenheim and Loeper,[17] Bogolomez,[18] Thomas [19] and others found degenerative changes in the suprarenal cortex in a variety of infections. These observations supported the view that the suprarenal cortex neutralizes bacterial toxins and aids in protecting the organism against bacterial invasion. Massive inoculations of pathogenic bacteria break down the defense mechanism in which the suprarenal cortex is involved, death resulting partially from suprarenal insufficiency. In 1931 Deanesly [20] revived this problem. By injecting daily into mice a suspension of killed Gärtner bacilli she was able to demonstrate an increase in the size of the suprarenals with a decrease in the lipid content of the cortical cells, congestion of the sinuses and capillaries and a neutrophilic infiltration. Deanesly's report on the lipid content of the cortical cells has been disputed by Whitehead.[21]

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14. Sullivan, R. C.; MacLean, A. B., and Zwemer, R. L.: A Comparison of the Chemical Composition of the Blood in Acute Intestinal Intoxication and Experimental Adrenal Insufficiency in Animals, Am. J. Dis. Child. **43**:1279 (May, pt. 1) 1932.

15. Roux, E., and Yersin, A.: Contribution à l'étude de la diphtérie, Ann. Inst. Pasteur **3**:2731, 1889.

16. Behring: Untersuchungen über das Zustandekommen der Diphtherie-Immunität bei Tieren, Deutsche med. Wchnschr. **16**:1145, 1890.

17. Oppenheim, R., and Loeper, M.: Lésions des capsules surrénales dans quelques infections expérimentales aiguës, Arch. de méd. expér. et d'anat. path. **13**:332, 1901.

18. Bogolomez, A.: Zur Frage über die Veränderungen der Nebennieren bei experimenteller Diphtherie, Beitr. z. path. Anat. u. z. allg. Path. **38**:510, 1905.

19. Thomas, E.: Ueber die Nebenniere des Kindes und ihre Veränderungen bei Infectionskrankheiten, Beitr. z. path. Anat. u. z. allg. Path. **50**:283, 1911.

20. Deanesly, R.: The Histology of Adrenal Enlargement Under Experimental Conditions, Am. J. Anat. **47**:475, 1931.

21. Whitehead, R.: The Cortical Lipoid of the Mouse Suprarenal After Unilateral Superarenalectomy, Brit. J. Exper. Path. **14**:149, 1933.

The suprarenal cortex contains relatively large amounts of carotene—primary vitamin A (Connor [22]) and hexuronic acid, which Szent-Györgi [23] demonstrated to be identical with vitamin C. These and other reports indicated a possible relationship between the suprarenals and the vitamins. In an attempt to elucidate this point, Lockwood and Hartman [24] studied the effect of their suprarenal cortex extract on the onset and amelioration of symptoms of vitamin C deficiency in guinea-pigs and of vitamin A and B_1 deficiency in rats. Their results show that the extract given early in the experiment delays the appearance of symptoms of avitaminosis B_1 and C. They stated that the extract exerted no influence on vitamin A deficiency.

Although the anti-infective activity of vitamin A is questioned at the present time, it was thought that the function of the suprarenal cortex and the action of vitamin A might be related so far as resistance to infection is concerned. One of us (Wenner) in collaboration with Dr. Rossleene Hetler placed a series of rats on a diet lacking in vitamin A. When the rats began to lose weight and showed signs of xerophthalmia, cortical extract was administered daily in doses of 1 to 2 cc. Our results so far show that the extract interferes with keratinization and increases the life span of animals kept on a diet lacking in vitamin A. This work was started before the article by Lockwood and Hartman appeared and will be reported in extenso at a later date.

The development of potent extracts of the suprarenal cortex offered a means of solving the many problems concerning the function of these cells, but no solution has come as yet from the many experimental and clinical investigations. The old question of the connection between the cortex and resistance to bacterial intoxication was again opened. Considerable evidence has appeared in the literature indicating that one of the many probable functions of the suprarenal cortex is linked with the protective mechanism. In 1931 Scott and Bradford [25] showed that the Swingle-Pfiffner [26] extract increased the resistance of suprarenalectomized rats to killed typhoid bacilli. Similar experiments

22. Connor, C. L.: Studies on Lipochromes: III. The Quantitative Estimation of Carotin in Blood and Tissues, J. Biol. Chem. **77**:619, 1928.

23. Szent-Györgi, A.: Observations on the Function of Peroxidase Systems of the Adrenal Cortex, Biochem. J. **22**:1387, 1928; Vitamin C, Adrenalin und Nebennieren, Deutsche med. Wchnschr. **58**:852, 1932.

24. Lockwood, J. E., and Hartman, F. A.: Relation of the Adrenal Cortex to Vitamins A, B and C, Endocrinology **17**:501, 1933.

25. Scott, W. J. M., and Bradford, W. L.: Effect of Adrenal Cortex upon Thymic Weight and Resistance to Bacterial Intoxication in Chronic Adrenal Insufficiency, Proc. Soc. Exper. Biol. & Med. **28**:428, 1931.

26. Swingle, W. W., and Pfiffner, J. J.: An Aqueous Extract of the Suprarenal Cortex, Science **71**:321, 1930.

were reported by Hartman and Scott [27] and by others. Whitehead and Smith [28] reported five hospital cases in which cortical extract had been used. The conditions included typhoid fever, undulant fever, postoperative erysipelas with a positive blood culture, lymphangitis with a positive blood culture and ethmoiditis with peribronchial adenitis. All the patients improved; the third showed some improvement after one intramuscular injection, but suffered a relapse and died before a second injection of extract could be given. In 1933 one of us (Wenner [29]) successfully treated rabbits which had experimental maxillary sinusitis with suprarenal cortex extract. After three intramuscular injections of extract in doses of 0.5 cc. kilogram of body weight the sinus mucosa showed no evidence of infection macroscopically or microscopically. Control animals macroscopically showed pus, thickening of the mucous membrane, cellular infiltration, loss of cilia and desquamation.

These results supplied sufficient grounds to warrant the clinical use of cortical extract. The cases listed in the table were selected by Dr. Cone. Abstracts of the histories of some of these cases are presented.

The extract used was prepared in this laboratory from whole beef suprarenal glands according to the method of Zwemer, Agate and Schroeder [30] and Zwemer, Agate and Sullivan.[31] The dosage varied from 2 to 7 cc., given intramuscularly at intervals of two or more days.

REPORT OF CASES

CASE 1.—J. W., a white woman, aged 19, had an infection of the upper respiratory tract of seven days' duration. No improvement was obtained with local treatment. The nasal membrane and the pharyngeal wall showed redness and edema. A distressing cough that was not controlled with sedatives began after the first week. Five cubic centimeters of suprarenal extract given intramuscularly was followed by prompt improvement in forty-eight hours.

CASE 2.—E. C., a white woman, aged 28, had an acute infection of the upper respiratory tract. Previously she had had repeated attacks of laryngitis quite resistant to all local treatment. The last attack of laryngitis in December, 1932, required hospitalization. An examination showed that the tonsils had been

27. Hartman, F. A., and Scott, W. J. M.: Protection of Adrenalectomized Animals Against Bacterial Intoxication, Proc. Soc. Exper. Biol. & Med. **28**:478, 1931.

28. Whitehead, R. W., and Smith, C.: Effect of Adrenal Cortex Extract on the Course of Certain Human Infections, Proc. Soc. Exper. Biol. & Med. **29**:672, 1932.

29. Wenner, W. F.: Effect of Extract of the Suprarenal Cortex on Maxillary Sinusitis in the Rabbit, Arch. Otolaryng. **17**:774 (June) 1933.

30. Zwemer, R. L.; Agate, R. J. Jr., and Schroeder, H. A.: A Method for Preparing an Active Adrenal Cortex Extract, Proc. Soc. Exper. Biol. & Med. **28**:721, 1931.

31. Zwemer, R. L.; Agate, F. J., Jr., and Sullivan, R.: Personal communication to the author, 1932.

removed. A tag at the base of the right tonsil was inflamed. The nasal membrane was edematous, and mucoid secretion was present postnasally. The larynx showed marked injection of the true and false vocal cords. The application of mono-*p*-chlorphenol to the larynx and ephedrine to the nose failed to bring about improvement. An intramuscular injection of 5 cc. of suprarenal extract brought about a marked improvement in forty-eight hours.

Results of the Use of Extract of the Suprarenal Glands

			Diagnosis							
			Sinusitis		Acute Infections of the Upper Respiratory Tract				Total Amount of Extract	
Patient	Sex*	Age, Years	Acute	Chronic	Mastoiditis	Laryngitis	Tracheitis	Cellulitis	Given, Cc.	Comment
S. U.	♂	62	..	+	..	..	..	..	30	Improved
G. R.	♂	27	..	..	..	..	..	..	6	Peritonsillar abscess ruptured about 32 hours after first injection
S. T.	♀	32	..	..	..	..	..	+	14	Improved
K. E.	♀	4	+	..	+	..	..	..	..	Good postoperative course
J. W.	♀	19	..	..	..	+	+	..	5	Improved
E. C.	♀	28	..	..	..	+	+	..	5	Improved
C. H.	♂	8	+	..	+	..	..	..	14	Patient had hemorrhagic nephritis; good postoperative course
N. I.	♂	62	+	..	..	..	..	..	5	Improved
G. A.	♀	40	+	..	..	..	..	..	12	Improved
C. O.	♀	45	..	+	..	..	..	..	16	Improved
A. L.	♂	47	+	..	..	..	..	..	5	Improved
M. C.	♂	14	..	+	..	..	..	..	30	Improved
B. E.	♀	24	..	+	..	+	..	..	30	Improved
H. A.	♀	28	+	..	..	..	..	..	20	Improved
O. R.	♀	25	+	..	..	..	..	..	15	Improved
K. L.	♂	27	..	..	..	..	..	+	18	Had excellent surgical care, improved
P. O.	♀	25	..	+	..	..	..	..	20	Improved
S. C.	♂	44	..	+	..	..	..	..	25	Improved
B. L.	♀	21	..	..	+	..	..	..	15	Extract given postoperatively, showed some improvement
J. B.	♀	25	+	..	..	..	..	..	15	Improved
C. O.	♂	31	+	..	..	..	..	..	20	Improved
V. M. C.	♀	21	+	..	+	..	..	..	15	Good postoperative course
R. E.	♀	43	+	..	..	..	..	..	15	Improved
W. G.	♀	38	+	..	..	..	..	+	25	Improved
W. I.	♀	19	+	..	..	..	..	..	5	Improved
J. M.	♂	30	+	..	..	..	..	..	10	Patient also had lymphangitis, improved
M. O.	♂	29	..	..	..	..	..	+	5	Patient received roentgenotherapy also, improved
R. D.	♂	29	+	..	..	..	..	..	10	Improved

* In this column, ♂ indicates male; ♀, female.

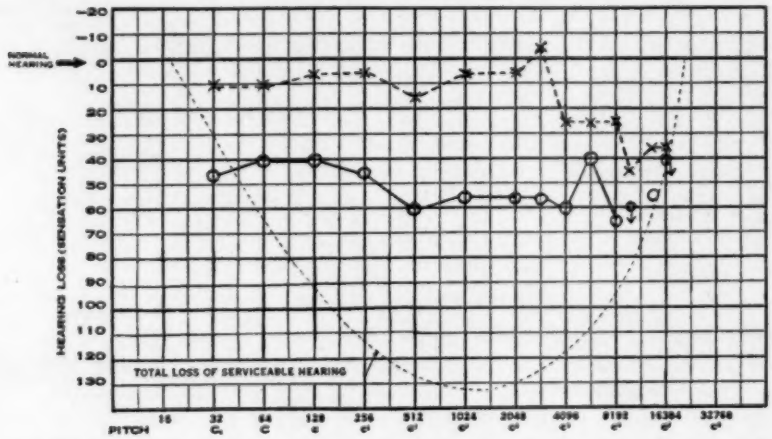
CASE 3.—V. M. C., a white woman, aged 21, entered the hospital on Jan. 7, 1934, with pain in the right ear of four days' duration. She had had otitis media one year previously. During the period of observation she had a severe cold with obstruction and a purulent nasal discharge.

Physical Examination.—The nose and mucous membrane were red and edematous; mucopus exuded profusely from the middle meatus on both sides with more severity on the right.

Ears: The right external canal was red and swollen, and just external to the drum membrane there were three bullous blebs extending onto the membrana

tympani. The drum was flat; there were no perforations. There was tenderness along the mastoid antrum. Acriflavine was applied to the ear and ephedrine and mild silver protein to the nose. On Jan. 11 there was a profuse purulent discharge from the right canal. A culture taken from the right canal was reported to show hemolytic streptococci. The bullous blebs in the canal disappeared. Five cubic centimeters of cortical extract was given intramuscularly. On January 13 the mucous membrane of the nose was pink and moist. There was a slight tenderness over the right mastoid antrum. On January 15 a roentgenogram showed a little haziness of the right mastoid. There were no signs of breaking down at that time. On January 16, 5 cc. of suprarenal extract was given. On January 19 the discharge from the right ear decreased. The canal was clean and the wall was clearing nicely; the right membrana tympani was still swollen and red, and there was less tenderness over the mastoid.

Nose: There was pus in the left ethmoid region. The mucous membrane on both sides was red and edematous.



Audiogram of V. M. C. (case 3). The line of circles shows the record for January 29; the line of crosses, the record for February 8.

Nasopharynx: The posterior end of the turbinates showed redness and edema. Transillumination disclosed blurring of the right frontal and right antrums.

Throat: There was some redness of the lateral pharyngeal bands.

Laboratory Data.—On January 9 the white cell count was 11,950. There were no basophils, eosinophils, myelocytes or juvenile forms. There were 11 stab and 50 segmented forms, 34 lymphocytes and 5 monocytes. On January 16, examination revealed 13,000 white cells, 2 eosinophils, no basophils, myelocytes, juvenile forms or monocytes, 6 stab and 61 segmented forms and 31 lymphocytes.

Subsequent Course.—On January 21, 5 cc. of suparenal extract was given. On January 22 the patient was discharged to the outpatient department where the right antrum was irrigated with physiologic solution of sodium chloride, and a large quantity of thick pus was obtained. A culture showed hemolytic streptococci; smears showed myriads of pus cells. On January 30 a mastoidectomy was performed because of continued tenderness over the mastoid, roentgenographic evidence of osseous destruction and a marked loss of hearing. On January 31 the

condition was fine with little febrile reaction. The patient was discharged on February 7. The postoperative course was unusually good. The suppurative maxillary sinusitis cleared up completely with one irrigation of physiologic solution of sodium chloride via the natural ostium.

The hearing returned practically to normal in eight days. An audiogram made by Dr. C. C. Bunch is shown in the chart.

CASE 4.—S. T., a white woman, aged 32, a private patient of Dr. Glick, entered the Lutheran Hospital on April 10, 1933, with swelling of the upper and lower lids of the right eye. Three days previously the patient had opened with a needle what appeared to be an infection of a hair follicle in the outer angle of the right eyebrow. On the following day an increased inflammatory reaction spread outward, involving the upper lid. Edematous swelling with discoloration soon involved the lower lid.

Examination.—Marked swelling and bluish discoloration of the lids were present; there was some proptosis of the eyeball; the conjunctiva of the lids was congested and turned outward over the margin. Edema and discoloration of the lids extended outward over the zygomatic arch and downward over the malar bone. The temperature was only slightly elevated. The Schilling cell count indicated a mild infection; there were no juvenile cells and 7 stab forms.

Course.—The treatment consisted of hot packs of boric acid, infra-red irradiation and intramuscular administration of vaccine. On the following day incisions were made into the depths of the swelling. No pus was obtained. Two days later the edema spread over the face to the median side below the chin and below the angle of the jaw. The temperature was 103 F. There was loss of light perception and movement of the right eye. Two days later the patient was unable to open her mouth. The white cell count was 20,000 with 12 per cent stab forms. Erysipelas antitoxin was given with little change in the condition. Two weeks later pus was obtained from areas of softening in the periorbital tissues. On May 4 the swelling and edema spread to the left eye. Four cubic centimeters of extract of suprarenal cortex was injected intramuscularly. On the following day the temperature was lower, and the swelling of the left eye had disappeared; the white cell count was 16,000; the Schilling count was normal; there were 5 per cent stab forms. The edema was decreased over the right lids but appeared increased over the right side of face. Three days later pus was obtained in the region of the angle of the jaw; an incision was made and a rubber dam inserted. Four days later 5 cc. of cortical extract was injected. During the next five days there was a steady improvement. The white cell count was 11,000; the Schilling count and the temperature were normal. The patient was allowed to sit up. On May 16 she received another injection of 5 cc. of cortical extract; her condition improved steadily; the mouth could be opened fully; the right eyeball, though proptosed, could be moved in all directions; there was no perception of light. On May 30 the patient was discharged from the hospital.

CASE 5.—G. R., a white man, aged 27, entered the Barnes Hospital on Feb. 4, 1933, with the complaint of sore throat. He had had fairly frequent attacks of tonsillitis during childhood.

Examination.—Nose: The mucous membrane was more pink than normal; there was a slight thickening of the nasal septum at the base, and some mucopurulent material was present in the left middle meatus.

Throat: On the left side the anterior pillar and the tonsil were acutely injected. The posterior wall of the pharynx was fairly normal in appearance.

Laboratory Data.—The white cell count was 14,000. Examination of the urine showed: a specific gravity of 1.025, a neutral reaction, no albumin and no sugar.

A culture of tonsillar material showed the predominant organism to be the hemolytic streptococcus. Smears revealed no spirilla or fusiform bacilli.

Treatment.—This consisted of hot saline irrigations and 5 grains (0.324 Gm.) of amidopyrine every four hours. The right tonsil became involved on February 6. The patient received a saline and dextrose solution intravenously. On February 7 an examination showed the left tonsil in the midline; the pillars were edematous and red. There was a moderate amount of edema of the uvula. Palpation of the throat revealed an area of infiltration about the right tonsil but no sign of breaking down. Six cubic centimeters of suprarenal cortex was given intramuscularly at 8:00 p. m.

On February 8 the white cell count was 13,800; the red cell count, 4,800,000. The right side of the throat did not appear to be as swollen or injected as previously. There was an increased swelling on the left side. There was apparently a peritonsillar abscess or the beginning of one. There was induration about the left tonsil on palpation, but no sign of breaking down. On February 9, at 8:00 a. m., it was observed that the peritonsillar abscess had apparently ruptured during the night. On February 10, the right side was more painful, but examination showed no more acute involvement. During the night of February 12 the patient raised about 6 cc. of pus. On February 14 the white cell count was 11,000; the red cell count, 4,500,000. On February 15 the condition was excellent. The patient was discharged on February 17.

Case 6.—B. E., a white woman, aged 24, stated that she had frequent colds in the head and recurrent attacks of laryngitis, sinusitis, influenza and pleurisy for the last eight years. During this time she had had six antral punctures, a submucous resection and a tonsillectomy. The present illness began in October 1933, with a cold in the head and sinusitis. Displacement therapy brought relief. The patient had had a low grade fever from 37.2 to 37.8 C. (98.96 to 100.4 F.) for four years. In December 1933 she had two colds with a severe laryngitis lasting from eight to nine days. She received three injections of cortical extract at intervals of two and three days from Dec. 17 to 22, 1933, and from Jan. 4 to 11, 1934, a total of 30 cc. She showed marked improvement after the second injection. Her temperature had remained normal up to the time of writing; she had noted less fatigue and felt better in general.

Case 7.—H. A., a white woman, aged 28, had a cold in the chest on Dec. 28, 1932. Four days later maxillary sinusitis started. Both the thoracic and the sinusal conditions responded to medical care. Her condition became worse following a trip by train on Jan. 14, 1933. At this time there were tenderness over the maxillary and frontal regions and a purulent nasal discharge. In spite of medical treatment the postnasal discharge continued. On February 8, 6 cc. of extract of suprarenal cortex was given intramuscularly. Four injections were given at intervals of two and three days, a total of 20 cc. of extract. By February 16, at the time of the last injection, the nasal discharge had stopped and did not recur.

Laboratory Data.—On February 8 the white cell count was 8,800. There were no basophils, 4 eosinophils, no myelocytes, no juvenile, 8 stab and 54 segmented forms, 32 lymphocytes and 2 monocytes. On February 10 the white cell count was 9,250. One basophil, 5 eosinophils, no myelocytes, no juvenile, 6 stab and 49 segmented forms, 35 lymphocytes and 4 monocytes were found. On February 13 the white cell count was 9,450, with no basophils, 4 eosinophils, no myelocytes, no

juvenile, 4 stab and 61 segmented forms, 29 lymphocytes and 2 monocytes. On February 16 the white cell count was 9,700. There were no basophils, 3 eosinophils, no myelocytes, no juvenile, 5 stab and 59 segmented forms, 29 lymphocytes and 4 monocytes. On February 9 the white cell count was 9,800.

SUMMARY

The results of this investigation indicate that cortical extract was effective in bringing about clinical improvement in pyogenic infections. The extract tends to reduce the temperature when it is elevated. The patients feel better generally. They are less easily fatigued and can withstand operative procedures much better. No direct effect of the extract on the total and Schilling differential white cell counts could be determined. The blood picture improved with the clinical improvement of the patient. No significant changes were observed in patients presenting normal white cell counts.

In cases of acute suppurative otitis with osseous involvement cortical extract did not alter the necessity for surgical intervention. However, when cortical extract was used preoperatively the postoperative course was better. The extract was effective in infections limited to the mucous membrane of the nose, sinuses, larynx and nasopharynx and in cases of cellulitis. In patients with a well developed inflammatory reaction in the mucous membranes and in whom the resistance to infection was decidedly poor, the best results were obtained when the extract was given at intervals not longer than forty-eight hours.

The response to pyogenic infections is probably due, in part, to an increased activity of the leukocytes. The opsonic power of the serum of both suprarenalectomized and normal animals is increased by injections of cortical extract (Blanchard [32]). We have been able to confirm Blanchard's observations on normal animals. Cortical extract injected intramuscularly increases the phagocytic activity of the leukocytes, but applied directly to suspensions of white cells it produces no noticeable change.

The evaluation of any preparation of suprarenal extract in infections is obviously a difficult problem.

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32. Blanchard, E. W.: An Experimental Study of the Opsonins of the Blood: 1. Effect of Bilateral Adrenalectomy, Physiol. Zool. **4**:302, 1931; Relation of Adrenal Cortical Function to Certain Aspects of Resistance, Anat. Rec. (supp.) **57**:30, 1933.

VISUALIZATION OF ACCESSORY SINUSES BY THE PROETZ METHOD

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The Proetz method of visualization of the accessory sinuses was first brought forward by Proetz in 1926.[1] Since then, he has fully discussed the advantages of this method and has given the procedure in detail in a number of articles [2] and in a recent book.[3]

Several papers on this method have been written by others. Amano [4] expressed the belief that it gives additional information about drainage of the posterior ethmoid and of the sphenoid sinuses, but is of little use in studying the rest of the sinuses. The size of the turbinate bones and the presence of polyps were important factors in causing the failure of cells to fill.

Goodyear [5] stated that the technical difficulties are so great that they discourage workers. Lobell [6] considered the Proetz method suited only to visualization of the posterior ethmoid sinuses. Frazee [7] found that, "In no instance has this method of diagnosis added any important find-

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1. Proetz, A. W.: A New Procedure in Sinus Diagnosis, Tr. Am. Laryng. A., 1926, p. 252.

2. Proetz, A. W.: Displacement Irrigation of Nasal Sinuses: A New Procedure in Diagnosis and Conservative Treatment, Arch. Otolaryng. **4**:1 (July) 1926; Physics of Sinus Drainage, Ann. Otol., Rhin. & Laryng. **36**:23 (March) 1927; Further Data on the Displacement Method in Sinuses, ibid. **36**:297 (June) 1927; Visualization of Sinus Drainage, ibid. **36**:978 (Dec.) 1927. Proetz, A. W., and Ernst, E. C.: Sinus Mapping by the Displacement Method, Radiology **8**:502 (June) 1927.

3. Proetz, A. W.: The Displacement Method of Sinus Diagnosis and Treatment, St. Louis, Annals Publishing Company, 1931.

4. Amano, K. W.: Paranasal Sinusitis: Opaque Displacement Diagnosis, Arch. Otolaryng. **15**:681 (May) 1932.

5. Goodyear, H. M.: Use of Iodized Oil in Diagnosis of Nasal Sinus Conditions, J. A. M. A. **95**:1002 (Oct. 4) 1930.

6. Lobell, A.: Injection of Iodized Oil into the Sinuses, with Special Reference to the Technique in the Sphenoidal Sinuses, Laryngoscope **37**:473 (July) 1927.

7. Frazee, J. R.: Disease of the Sinuses: Diagnosis and Treatment by Displacement, Arch. Otolaryng. **17**:554 (April) 1933.

ing not previously shown in routine roentgen examination of the sinuses."

Lyman [8] recommended a trial of the Proetz procedure when the usual roentgenograms or clinical symptoms have failed to establish a definite diagnosis.

Three articles were found in the foreign literature on the subject. Bernard and Sourice,[9] Le Mee and Bouchet [10] and Le Mee,[11] working in France, found the method easy to perform and helpful in locating aberrant cells; it also gave an idea of the evacuation time and permitted rapid choosing of cases for medical and surgical treatment.

In our series of sixty-eight cases the sinuses were filled with oil either completely or with only a slight amount in either side, as follows: sphenoid sinuses, 82.2 per cent; posterior ethmoid sinuses, 66.2 per cent; antrums, 62.2 per cent; anterior ethmoid sinuses, 20.3 per cent; frontal sinuses, 14.8 per cent, and no filling, 9.5 per cent.

Proetz stated that even if only one cell fills, it shows that the technic is correct. If the position is correct and the correct amount of oil is added, the other sinuses should fill. In our series the sinuses filled, partially or completely, in 90.5 per cent. Thus we believe that our technic was correct.

It is difficult to evaluate the aid that the roentgenologist obtains from the Proetz method in the examination of sinuses. In the first place, it is difficult to check the roentgenographic findings, either with or without the use of contrast mediums, because the correct diagnosis remains questionable even after the clinical facts have been obtained or often even after exploratory operation. In this report plain roentgenograms and roentgenograms made by the Proetz method were compared as to their value in making a diagnosis.

The plain roentgenograms were studied for cloudiness in the sinuses as ordinarily interpreted in the diagnosis of disease of the sinuses. These findings were then compared with those obtained by the Proetz method. Both were checked with the clinical findings.

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8. Lyman: Displacement Irrigation of the Nasal Sinuses with Suction, J. Indiana M. A. **21**:60 (Feb.) 1928.

9. Bernard, P. M., and Sourice: Utilization of the Displacement Method of Proetz to Explore the Cranial Sinuses, Bull. et mém. Soc. de radiol. méd. de France **19**:454 (Nov.) 1931.

10. Le Mee, J. M., and Bouchet, M.: The Displacement Method of Proetz in the Diagnosis and Treatment of the Sinuses, Presse méd. **40**:393 (March 12) 1932.

11. Le Mee: The Presentation of an Apparatus Permitting Exploration of the Cranial Sinus Previously Filled with Opaque Liquid, Bull. et mém. Soc. de radiol. méd. de France **20**:22 (Jan.) 1932.

The roentgenographic interpretation was made without any knowledge of the clinical findings. In the cases in which there was no cloudiness, as noted without regard to the visualization by iodized poppy-seed oil 40 per cent, a diagnosis of normal sinuses was made.

No attempt was made to fill other than the ethmoid and sphenoid cells by the Proetz method. Often a small amount of oil entered the maxillary sinuses, and in a few cases the frontal sinuses were visualized. Because of the difficulty in interpretation little attention was paid to the emptying, it being our plan to determine, if possible, the advantages of roentgenograms made by the Proetz method over plain roentgenograms, as shown by the ability to visualize the ethmoid and sphenoid cells.

The various types of cases are divided and discussed in the following order: (1) allergic cases, (2) purulent cases, (3) hyperplastic cases, (4) cases in which the sinuses were normal clinically and (5) cases in which no conclusions could be drawn. A few case reports are given to show how the Proetz procedure assisted in establishing a diagnosis.

The allergic group totaled eleven cases. According to Proetz,[12] it is difficult to fill the sinuses of allergic patients when they have even a mild attack.

In the plain film, the sinuses in seven of the eleven cases were cloudy and in four, clear. Thus the findings in the plain roentgenograms check with the clinical findings in 63 per cent of the cases. In the cases in which the sinuses were clear the cells filled 100 per cent. In the seven cases in which the sinuses were cloudy, the cells in four filled. Thus, the sinuses in eight cases filled by the Proetz method and those in three cases did not. No difference could be seen between the cases clinically. The plain films seemed more reliable than the films made by the Proetz method, but the occurrence of filling helped rule out infection in about 36 per cent of the cases.

There were eight cases of frankly purulent infection of the sinus. In all of these cases the plain film showed one or more definitely cloudy sinuses. None showed the sphenoid and ethmoid cells to fill normally by the Proetz method. Therefore, the results with both methods checked with the clinical findings. There were three cases, however, in which a sphenoid cell was visualized, and one case in which the ethmoid cells filled. Distinct aid, therefore, was obtained by the Proetz method in 50 per cent of the cases, in that the method more accurately showed which sinuses were involved.

There were eighteen cases in the hyperplastic group, in which there were a boggy mucous membrane and a slight discharge postnasally or

12. Proetz,[3] p. 181.

through the nose, or symptoms that might be caused by sinus infection, such as headache, eye strain and sore throat.

Ten cases showed one or more cloudy sinuses in the plain roentgenogram. In the remaining eight, the sinuses appeared to be clear. Therefore, the roentgen diagnoses checked with the clinical findings as determined by the plain roentgenogram in 55 per cent of the cases. There was some filling of cells by the Proetz method in fourteen cases, in seven of which there were cloudy sinuses and in seven clear sinuses. In this group we found our greatest difficulty in the interpretation of the findings. If we accept Proetz' teaching that a sinus is normal only when all the cells are filled, we have a high degree of accuracy in this group, for none showed good filling of all the cells.

In our hands, the greatest difficulty was experienced in evaluating the case in which all cells filled except perhaps one in the ethmoid group. How can one be sure that such a cell is diseased? Did some factor other than disease prevent it from filling, or was the anatomic development such that there was no cell in that particular location? It was our inability to satisfy ourselves on these questions that made us feel that until more statistics are published pertaining to this point we are not justified in drawing too dogmatic conclusions. We had one case in this group that illustrates this point. The sinuses appeared clear in the plain roentgenograms, but there was poor filling by the Proetz method. On exploration, no pathologic process could be demonstrated in any of the cells.

We feel that some aid was obtained in the group of cases in which the sinuses were cloudy, in that infection in certain sinuses was ruled out. In the group in which all sinuses were clear in the plain roentgenogram, there was one case, already cited, in which the cells did not fill, and therefore the method hindered rather than helped. Help was obtained in not more than 38 per cent of the cases in this group.

Cases in which the sinuses were normal clinically and filled well with the Proetz method totaled nine. All the cases except one showed fairly good filling, but in the case in which the sinuses were slightly cloudy the sphenoid cells were not well filled, and in one other case the ethmoid cells were not symmetrically filled. We felt, however, that this was an anatomic variation. It would appear that by the method the normal variations of the ethmoid and sphenoid cells can be easily studied in symptomless persons. Not having an extensive knowledge of the normal variations, we experienced great difficulty in determining whether or not a normal variation in size, shape or position of a cell existed or whether the lack of a well filled cell was due to nonfilling as the result of disease. We usually decided that if the preponderance of evidence from other sources indicated a normal condition, the cell under suspicion was an anatomic variation. On the other hand, if the

other available information indicated disease, we interpreted the findings as indicative of disease. Thus, the method ceased to be of help from the roentgenologist's point of view. However, it was an excellent check on the negative results of nasal examination and on negative plain roentgenograms.

Cases in which the sinuses were normal clinically and showed incomplete or no filling by the Proetz method totaled seven. The sinuses were slightly cloudy in four cases, and help was obtained by the Proetz method in one of these which showed the sphenoid cells to be normal. In the three cases in which all sinuses were clear in the plain roentgenogram, the sphenoid cells were all visualized, although the ethmoid cells did not fill. Some help was obtained in four cases in this subdivision. In the other three cases the picture obtained by the Proetz method would have indicated surgical intervention or nasal treatment, and yet there were no positive clinical symptoms or findings.

The questionable cases totaled fifteen. We expected to obtain our greatest help in this group. The plain roentgenograms showed one or more cloudy sinuses in nine cases, and the sinuses appeared to be normal in only six. In the latter group all sinuses were well filled by the Proetz method, so that no additional help was obtained from this procedure. In the nine cases in which the sinuses were cloudy, only three showed good filling. Therefore, we were greatly disappointed by the fact that the Proetz method furnished diagnostic aid in only 20 per cent by demonstrating certain sinuses to be normal in those cases in which the plain roentgenograms showed them to be slightly cloudy.

REPORT OF CASES

In the following cases the Proetz method aided in establishing a diagnosis.

CASE 1.—The patient complained of the nose being blocked and of a yellow discharge, occasional headache and articular rheumatism. Examination showed pansinusitis on the left side, the right side being clear. With the regular roentgen examination, the roentgenologist reported all the sinuses on the left to be hazy. By the Proetz method, the left posterior ethmoid cells filled and emptied normally. According to our findings and the plain roentgenogram, an operation was indicated on the left side. The picture obtained with the Proetz method indicated that the left antrum and the adjoining ethmoid cells were infected. A radical operation on the left antrum and removal of the anterior part of the left middle turbinate bone resulted in complete relief. It is felt that in this case the Proetz procedure saved the patient from an extensive operation on the ethmoid and sphenoid sinuses.

CASE 2.—The patient complained of intense periodic headaches over the top of the head, lasting from one to five days, and occurring any time from months to a week apart. Nasal examination gave negative results. A plain roentgenogram showed clear sinuses. On examination with the Proetz method, we found good filling of all the sinuses and a normal emptying time. The Proetz procedure helped confirm the diagnosis that the headache was not caused by the sinuses.

CASE 3.—The patient complained of constant postnasal drip and rheumatism. There were no headaches, and the nose was open most of the time. Nasal examination showed a dark right antrum on transillumination and hyperplastic edematous tissue in the posterior ethmoid-sphenoid region of each side. The tonsils were chronically infected. A plain roentgenogram was suggestive of infection of the ethmoid and sphenoid sinuses. The Proetz method showed good filling and emptying of all the sinuses. The patient's nasal condition rapidly cleared under treatment. Roentgenograms by the Proetz method indicated no real pathologic process in the ethmoid and sphenoid sinuses. This was confirmed by the rapid clearing of the condition under treatment.

CASE 4.—The patient had a postnasal discharge varying from white to yellow. The nose was blocked in the morning, and at times there was pain around the eyes. On examination there was apparently pansinusitis on both sides. Considerable pus was washed from each antrum. A plain roentgenogram indicated infection in both antrums and questionable infection in the ethmoid and sphenoid sinuses. On examination by the Proetz method the ethmoid and sphenoid cells were found to be filled. Treatment directed to the antrums cleared up the symptoms, except that pus continued to be washed from each antrum. An operation on the antrums was advised, but as the patient was feeling well permission was refused. In this case the Proetz method ruled out infection in the ethmoid and sphenoid sinuses and allowed us to direct all our attention to the antrums, with good results.

CASE 5.—The patient complained of deafness and ringing in the ears, and the nose was stopped up. There was no nasal discharge or headaches. The nasal condition was worse each winter. On examination, polyps were found around the middle turbinate bone on the left. There was a small space between the septum and the turbinate bones on the right. The Proetz procedure indicated fairly normal sinuses, as they filled well and emptied within seventy-two hours. When the polyps were removed the patient could breathe easily and had no complaint as far as the nose was concerned. The ringing and deafness continued. Before using the Proetz procedure there was some indication for an ethmoidectomy on the left side. However, all that was necessary was removal of the polyps.

CASE 6.—The patient complained of postnasal discharge and blocking of the nose, which had been present for a number of years. Examination showed a septum deflected to both sides, but worse on the right. Considerable congestion and a thick mucopurulent secretion were observed in the region of the right posterior ethmoid sinuses. A plain roentgenogram indicated infection in the right posterior ethmoid sinuses. With the Proetz procedure, there was no filling in this region. The rest of the sinuses filled and emptied normally. An operation was advised, but the patient refused it. In this case the Proetz procedure confirmed the findings obtained with other methods.

CONCLUSIONS AND SUMMARY

1. The Proetz method is simple, safe and practicable.

2. The most reliable evidence is a well filled cell, indicating a normal condition.

3. The method provided the greatest help in the frankly purulent cases by excluding involvement of certain sinuses.

4. The least help was obtained in the questionable cases.

5. The method was apparently less accurate than plain roentgenography in the cases of clinically normal sinuses.

6. The method gives information as to the shape, size and position of the posterior ethmoid and sphenoid cells when they are visualized.

7. Reports of cases were given to show the aid rendered by the Proetz procedure.

8. Lack of filling may or may not be indicative of a pathologic process. Therefore, great difficulty is experienced in properly interpreting or evaluating the sinuses that do not fill in borderline or clinically indeterminate cases.

9. Plain roentgenograms should always be made first. Confirmation by visualizing the sinuses by the Proetz method gives the greatest amount of correct information.

10. Sinuses that appear normal in a plain roentgenogram but which do not fill by the Proetz method should not be considered pathologic except on definite evidence that there is no anatomic variation present and also on substantiation by positive clinical evidence.

11. Further studies should be made as to the significance of the failure of a few cells to fill in the presence of many well filled cells.

12. In our series of sixty-eight cases, diagnostic help was obtained from the Proetz method in 29.4 per cent. It was of no help in 64.8 per cent and apparently gave incorrect results in 5.8 per cent.

ANATOMIC STUDIES OF THE PETROUS PORTION OF THE TEMPORAL BONE

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The writings of Profant, Eagleton, Kopetzky and Almour, Friesner and Druss, and Voss have stimulated a widespread interest in the subject of suppuration of the petrous pyramid during the past few years. As far back as 1904 Mouret [1] carried out systematic anatomic studies on the petrous pyramid. At that time he evidenced his understanding of infection of the petrous tip. He stated that "if the cellular arrangement favors an infection of the mastoid process in the presence of suppuration of the middle ear and facilitates the retention of pus in that part of the temporal bone, it is easy to understand how the pus can be extended into the perilabyrinthine cells and cause necrosis of the petrous pyramid."

A series of 200 temporal bones were studied in 100 autopsies. These bones were studied in their normal position and relationship within the skull with the brain intact and also after they were excised. A better understanding of the cell groupings or arrangements of the petrous pyramid can be obtained by studying this part of the bone both *in situ* and after removal and by means of roentgenography and gross sections after removal. The cellular structure of both the mastoid and the petrous portions was noted. In addition dyes were introduced into the apex of the removed petrous bones to ascertain whether the dye would pass through one or more groups of cells. Sodium iodide and iodized poppy-seed oil 40 per cent were used with the roentgenographic studies but were found to be of no special value. The channels of pneumatization were further studied and in many instances recorded by means of photographs. The nerves and vessels in proximity to the petrous apex were studied. It was hoped thus to secure a better understanding of the various clinical pictures and syndromes which have been observed in involvement of the petrous pyramid as a complication of mastoiditis. At the same time various operations

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1. Mouret, J.: Nouvelle recherches sur les cellules petreuses, Rev. hebd. de laryngol. **25**:753 (Dec. 24) 1904.

TABLE 1.—*Observations on Tabulation of 100 Pairs (200 Specimens) of Temporal Bones*

Case	Age	Sex*	Color†	Type of Mastoid Process	Type of Petrous Bone	Measurements, Cm.		Comment	Cause of Death
						From Superior Semicircular Canal to Petrous Tip	From Internal Lip of Internal Auditory Meatus to Petrous Tip		
1	7 months' fetus	♂	W	Nonpneumatic	Nonpneumatic	1.6	0.8	.....	Premature birth
2	1 day	♀	W	Nonpneumatic	Nonpneumatic	1.9	0.8	.....	Omitted
3	2 days	♂	W	Nonpneumatic	Nonpneumatic	2.0	1.0	.....	Omitted
4	7 days	♂	C	Nonpneumatic	Nonpneumatic	1.6	0.6	.....	Omitted
5	17 days	♂	W	Diploic	Nonpneumatic	1.8	0.6	Pus in right mastoid	Bronchopneumonia
6	23 days	♂	W	Nonpneumatic	Nonpneumatic	1.9	1.0	.....	Bronchopneumonia
7	1½ months	♀	W	Nonpneumatic	Nonpneumatic	2.0	1.0	.....	Bronchopneumonia
8	3 months	♀	W	Nonpneumatic	Nonpneumatic	1.5	0.5	Pus in middle ear, bilaterally	Pneumonia
9	3 months	♂	C	Nonpneumatic	Nonpneumatic	1.5	0.5	.....	Omitted
10	3 months	♀	C	Diploic	Nonpneumatic	2.0	1.1	.....	Bronchopneumonia
11	5 months	♂	W	Nonpneumatic	Nonpneumatic	2.0	1.0	.....	Pneumonia and peritonitis
12	7 months	♂	W	Nonpneumatic	Nonpneumatic	1.9	0.5	Bilateral otitis media	Meningitis
13	8 months	♀	C	Nonpneumatic	Nonpneumatic	2.0	1.0	Bilateral otitis media	Pneumonia
14	9 months	♂	W	Nonpneumatic	Nonpneumatic	2.3	1.3	.....	Bronchopneumonia
15	3½ years	♂	W	Nonpneumatic	Nonpneumatic	2.0	1.0	Right mastoiditis; left otitis media	Meningitis
16	4 years	♀	C	Nonpneumatic	Nonpneumatic	3.2	1.6	.....	Dehydration
17	6½ years	♂	W	Diploic	Nonpneumatic	1.8	0.8	.....	Fractured skull
18	7½ years	♀	W	Pneumodiploic	Nonpneumatic	2.2	1.2	Simple mastoidectomy, positive blood culture	Meningitis, sinus thrombosis
19	15 years	♂	W	Diploic	Diplosclerotic	3.3	2.3	Bilateral sinusitis, positive spinal fluid, meningitis	Leukemia
20	20 years	♀	W	Diploic	Nonpneumatic	3.7	2.2	.....	Encephalitis
21	22 years	♀	W	Diploic	Nonpneumatic	3.2	2.1	.....	Ruptured lung
22	23 years	♀	W	Pneumatic	Nonpneumatic	3.2	2.1	.....	Omitted
23	24 years	♂	W	Diploic	Diplosclerotic	3.2	2.4	.....	Omitted
24	24 years	♂	C	Pneumatic	Diploic	3.5	2.1	.....	Omitted
25	24 years	♀	C	Sclerotic	Diplosclerotic	3.4	2.2	.....	Pernicious anemia
26	25 years	♂	W	Pneumatic	Diploic	3.6	2.4	.....	Bullet wound in lung
27	25 years	♀	W	Nonpneumatic	Nonpneumatic	3.2	2.1	.....	Tumor of the brain
28	27 years	♂	C	Pneumatic	Nonpneumatic	3.3	2.2	Fracture through both petrous pyramids	Fractured skull
29	27 years	♂	C	Nonpneumatic	Nonpneumatic	3.2	2.1	.....	Omitted
30	28 years	♀	C	Pneumatic	Nonpneumatic	2.9	2.3	.....	Pulmonary tuberculosis
31	29 years	♂	C	Pneumatic	Pneumatic	3.6	2.2	See table 3, specimens 1 and 2	Peritonitis
32	29 years	♂	W	Diploic	Diploic	3.7	2.0	.....	Bullet wound in brain
33	30 years	♂	W	Pneumatic	Nonpneumatic	3.4	2.0	.....	Fractured skull
34	30 years	♂	W	Pneumatic	Pneumatic	3.8	2.2	See table 3, specimens 3 and 4	Fractured skull
35	30 years	♀	C	Pneumatic	Pneumatic	3.1	2.1	See table 3, specimens 7 and 8	Peritonitis
36	31 years	♀	W	Pneumatic	Pneumatic	3.4	2.3	See table 3, specimens 5 and 6	Omitted

37	32 years	♂	W	Pneumatic	Nonpneumatic	3.2	2.1	.....	Omitted
38	32 years	♀	C	Pneumatic	Nonpneumatic	3.2	2.1	.....	Myocarditis
39	32 years	♂	W	Pneumatic	Nonpneumatic	3.3	2.2	Bullet passed through left petrous apex	Bullet wound in brain
40	33 years	♂	W	Diploic	Right, nonpneumatic; left, pneumatic	3.3	1.1	See table 3, specimen 19	Abdominal injury
41	33 years	♀	W	Pneumatic	Diploic	3.2	2.1	Pus in middle ear around labyrinth	Tuberculosis
42	33 years	♂	W	Pneumatic	Nonpneumatic	3.3	2.0	Dehiscence in roof of left middle ear	Cerebral hemorrhage
43	33 years	♂	W	Diplopneumatic	Nonpneumatic	3.2	2.2	.....	Omitted
44	34 years	♂	C	Diploic	Diploic	3.3	2.3	.....	Aortic aneurysm
45	34 years	♂	C	Pneumatic	Right, pneumatic; left, nonpneumatic	3.8	2.3	See table 3, specimen 20	Diabetes
46	35 years	♂	W	Sclerotic	Sclerotic	3.6	1.9	.....	Omitted
47	35 years	♀	C	Nonpneumatic	Nonpneumatic	3.3	2.3	.....	Omitted
48	37 years	♂	W	Diploic	Nonpneumatic	3.6	2.4	.....	Fractured skull
49	37 years	♂	C	Pneumatic	Pneumatic	3.4	1.9	See table 3, specimens 11 and 12	Omitted
50	38 years	♀	C	Nonpneumatic	Nonpneumatic	3.4	2.2	.....	Omitted
51	38 years	♂	W	Nonpneumatic	Nonpneumatic	3.3	2.5	Bilateral otitis media	Abscess of kidney
52	39 years	♀	W	Pneumatic	Diplosclerotic	3.2	2.2	Few small cells in petrous tip internal to auditory meatus	Peritonitis
53	40 years	♂	C	Nonpneumatic	Nonpneumatic	3.6	2.4	.....	Omitted
54	40 years	♂	W	Pneumatic	Diploic	3.1	2.1	.....	Fractured skull
55	40 years	♂	W	Diplosclerotic	Nonpneumatic	3.4	2.0	.....	Omitted
56	40 years	♂	W	Diploic	Nonpneumatic	3.5	2.4	.....	Cerebral thrombosis
57	40 years	♂	C	Pneumatic	Pneumatic	3.1	2.0	See table 3, specimens 15 and 16	Omitted
58	41 years	♀	W	Diploic	Nonpneumatic	3.8	2.2	.....	Omitted
59	41 years	♂	W	Diploic	Nonpneumatic	3.8	1.9	.....	Tumor of the brain
60	42 years	♀	W	Nonpneumatic	Nonpneumatic	3.2	2.1	.....	Landry's paralysis
61	42 years	♂	W	Pneumatic	Left, pneumatic; right, nonpneumatic	3.4	2.5	See table 3, specimen 9	Lobar pneumonia
62	42 years	♂	W	Pneumatic	Nonpneumatic	3.2	2.2	.....	Omitted
63	42 years	♂	W	Diploic	Nonpneumatic	3.2	2.2	.....	Bullet wound in abdomen
64	44 years	♂	C	Nonpneumatic	Nonpneumatic	3.4	2.3	.....	Endocarditis
65	45 years	♀	W	Pneumatic	Nonpneumatic	3.3	2.3	Fracture through both petrous pyramids	Fractured skull
66	45 years	♂	C	Pneumatic	Nonpneumatic	3.3	2.2	.....	Cardiac failure
67	45 years	♀	W	Diploic	Nonpneumatic	3.5	1.9	.....	Omitted
68	45 years	♂	W	Diploic	Diploic	3.4	2.3	.....	Abdominal injury
69	45 years	♂	W	Pneumatic	Diploic	3.4	2.4	.....	Omitted
70	50 years	♂	W	Pneumatic	Pneumodiploic	4.0	2.2	See table 3, specimens 21 and 22	Carbon dioxide poisoning

* In this column, ♂ indicates male; ♀, female.
† In this column, W indicates white; C, colored.

TABLE 1.—*Observations on Tabulation of 100 Pairs (200 Specimens) of Temporal Bones—Concluded*

Case	Age	Sex*	Color†	Type of Mastoid Process	Type of Petrous Bone	Measurements, Cm.		Comment	Cause of Death
						From Superior Semicircular Canal to Petrous Tip	From Internal Lip of Internal Auditory Meatus to Petrous Tip		
71	50 years	♀	W	Nonpneumatic	Nonpneumatic	3.3	2.2	.....	Valvular disease
72	50 years	♀	W	Sclerodiploic	Diploic	3.6	2.5	Tip more diploic than mastoid	Valvular disease
73	50 years	♂	W	Diplopneumatic	Nonpneumatic	3.5	1.7	.....	Cardiovalvular disease
74	51 years	♂	W	Diploic	Nonpneumatic	3.2	2.2	.....	Cardiovalvular disease
75	52 years	♀	W	Nonpneumatic	Nonpneumatic	3.2	2.2	.....	Omitted
76	53 years	♂	W	Pneumatic	Sclerotic	3.6	2.2	.....	Peritonitis
77	60 years	♂	C	Pneumosclerotic	Nonpneumatic	3.1	1.7	.....	Valvular disease
78	60 years	♀	C	Pneumatic	Nonpneumatic	3.5	2.1	.....	Pneumococcic meningitis
79	60 years	♂	W	Pneumatic	Nonpneumatic	Right, 3.1; left, 4.5	Right, 2.1; left, 3.5	Left tip largest in collection	Cardiorenal disease
80	60 years	♂	W	Diploic	Nonpneumatic	3.5	2.2	.....	Arteriosclerosis
81	60 years	♂	W	Diploic	Nonpneumatic	3.5	2.2	.....	Arteriosclerosis
82	61 years	♂	W	Diploic	Nonpneumatic	3.3	1.8	.....	Coronary disease
83	61 years	♂	W	Pneumatic	Sclerodiploic	3.5	2.7	.....	Coronary disease
84	62 years	♂	C	Diploic	Nonpneumatic	3.4	2.3	.....	Syphilitic aortitis
85	62 years	♂	W	Pneumatic	Diplosclerotic	3.9	2.2	.....	Ruptured heart
86	62 years	♂	W	Pneumatic	Diplosclerotic	3.2	2.1	Parapharyngeal abscess, retro-esophageal abscess	Mediastinitis
87	63 years	♂	W	Pneumatic	Sclerotic	3.5	1.9	.....	Omitted
88	64 years	♂	W	Diploic	Diploic	3.8	2.1	.....	Omitted
89	66 years	♂	W	Pneumatic	Nonpneumatic	3.4	1.9	.....	Pneumonia
90	68 years	♂	W	Pneumatic	Diploic	3.9	1.9	.....	Pancreatitis
91	70 years	♂	W	Diploic	Nonpneumatic	3.6	2.3	Blood in middle ear and labyrinth	Fractured skull
92	72 years	♂	W	Pneumosclerotic	Pneumatic	3.7	2.1	See table 3, specimens 13 and 14	Omitted
93	72 years	♂	W	Nonpneumatic	Nonpneumatic	3.9	2.2	.....	Omitted
94	72 years	♂	C	Pneumatic	Pneumatic	3.3	2.3	See table 3, specimens 17 and 18	Poisoning
95	74 years	♂	W	Nonpneumatic	Sclerotic	3.8	2.2	.....	Cerebral hemorrhage
96	79 years	♂	W	Pneumatic	Nonpneumatic	3.9	2.0	.....	Coronary artery disease
97	79 years	♂	W	Nonpneumatic	Nonpneumatic	3.2	2.1	.....	Arteriosclerosis
98	80 years	♂	W	Diploic	Nonpneumatic	3.1	2.1	.....	Omitted
99	81 years	♂	C	Pneumatic	Nonpneumatic	3.2	2.4	Dehiscences in both superior semicircular canals	Osteomalacia
100	85 years	♀	W	Diploic	Right, pneumatic; left, nonpneumatic	3.2	2.2	See table 3, specimen 10	Nephritis

* In this column, ♂ indicates male; ♀, female.
† In this column, W indicates white; C, colored.

which have been advocated were repeated on the cadaver on several occasions. All the available literature was reviewed.

The bones were studied and classified according to their structure. In addition the length of the petrous pyramid and that of the petrous tip were noted. The petrous pyramid was measured from the superior semicircular canal to the apex, and the petrous tip was measured from the internal lip of the internal auditory meatus to the apex.

Table 1 lists the 200 bones which were studied and is arranged according to the age of the patients so as to enable one to analyze the possible bearing of age on the cellular structure. It will be noted that 28 specimens of infants under 1 year of age were studied and that pneumatization was not encountered in any. Only in the bone of a boy, aged 15 years, did we encounter a petrous portion which was at all pneumatized; in this case the bone was diplosclerotic.

TABLE 2.—*Classification of Cellular Structure of 200 Mastoid and 200 Petrous Bones*

	Mastoid Bone		Petrous Bone	
	Number	Percentage	Number	Percentage
Pneumatic	76	38	22	11.0
Diploic	50	25	22	11.0
Diplosclerotic	4	2	13	6.5
Sclerotic	60	30	143	71.5
Pneumodiploic	6	3		
Pseudosclerotic	4	2		

An analysis of table 2 reveals the relatively small number of well pneumatized petrous pyramids. Our figure (11 per cent) indicates a much lower incidence than that reported by other authors. There were 76 (38 per cent) pneumatized mastoid processes and 22 (11 per cent) pneumatized petrous pyramids. This makes it evident that not every pneumatized mastoid is associated with a pneumatized petrous portion. In this series there were nearly four times as many pneumatized mastoid processes as pneumatized petrous pyramids. There were 50, or 25 per cent, diploic mastoids. The pneumatized and diploic mastoids numbered 126, or 63 per cent, while the pneumatized and diploic petrous bones numbered 44, or 22 per cent. Of the 200 mastoid processes 60, or 30 per cent, were sclerotic, while the remaining 140, or 70 per cent, had some degree of pneumatization.

In the bones in which the petrous pyramids were pneumatized the cell channels from the mastoid process to the petrous tip were studied.

It was decided to divide the cell channels into two main groups, the supracochlear and the infracochlear cells. To accomplish this an arbitrary line was drawn through the highest point of the cochlea. This line served to divide the two main groups of cells. The supracochlear

* In this column, ♂ indicates male; ♀, female.
† In this column, W indicates white; C, colored.

TABLE 3.—*Analysis of 22 Pneumatized Petrous Portions of the Temporal Bone*

Specimen	Supracochlear Cells			Infracochlear Cells			Petrous Tip Cells		Type of Mastoid Process	Observations: Cell Channels and Other Data
	(1) Anterior Surface Cells	(2) Superior Border Cells	(3) Posterior Surface Cells	(1) Anterior to Cochlea	(2) Subcochlear	(3) Posterior to Cochlea	(1) Supracarotid	(2) Infracarotid and Posterior to Carotid		
1. Male, colored, age 29, right	Many well developed	Many well developed	Many well developed	None	Few well developed	Many well developed	Several large, few small	Many large	Pneumatic	Well developed cell channels, three supracochlear and one infracochlear; iodized poppy-seed oil 40 per cent injected at the tip went through and came out of the mastoid cells
2. Same, left	Many well developed	Many well developed	Many well developed	None	Few well developed	Many well developed	Several large, few small	Many large	Pneumatic	Well developed cell channels, three supracochlear and one infracochlear; iodized poppy-seed oil 40 per cent injected at the tip went through and came out of the mastoid cells (fig. 3)
3. Male, white, age 30, right	None	Many moderate sized	Many large	None	None	Many well developed	One large and many small	Several small	Pneumatic	Well developed cell channels, two supracochlear and one infracochlear (fig. 4)
4. Male, white, age 30, left	Few small	Many large	Many large	None	Few small	Many well developed	One very large and many small	None	Pneumatic	Well developed cell channels, two supracochlear and one infracochlear
5. Female, white, age 31, right	Many well developed, a few above the eustachian tube	Few small	Several medium sized	Few small	Few large	Several medium sized	Several large	Several moderate sized	Pneumatic	Well developed cell channels, one supracochlear and one infracochlear; pneumatic zygomatic cells extending forward to the glenoid fossa and communicating with the pterygomaxillary fossa through a dehiscence in the bone
6. Same, left	Many well developed, a few above the eustachian tube	Few small	Several medium sized	Few small	Few large	Several medium sized	Several large	Several moderate sized	Pneumatic	Well developed cell channels, one supracochlear and one infracochlear; zygomatic cells the same as in the preceding specimen
7. Female, colored, age 30, right	Several well developed	Few well developed	Few well developed	Few small	Several small, two cells communicate with middle ear	None	Several moderate sized	Few small	Pneumatic	Well developed cell channels, one supracochlear and one infracochlear; some of the infracochlear cells communicated with the middle ear

8. Female, colored, age 30, (same) left	Several well developed	Few well developed	Few well developed	Few small	Several small, two cells communicate with middle ear	None	Several moderate sized	Few small	Pneumatic	Well developed cell channels, one supracochlear and one infracochlear; some of the infracochlear cells communicated with the middle ear
9. Male, white, age 42, left	None	None	Few small	None	Many well developed	Many well developed	Many moderate sized	Many moderate sized	Pneumatic	Well developed cell channels, no supracochlear, two infracochlear; left tip pneumatic, but opposite side nonpneumatic; these cells represent the jugular bulb route to the petrous apex
10. Female, white, age 85, right	None	None	None	None	Few moderate-sized cells end blindly over the jugular bulb	Few moderate-sized cells end blindly over the jugular bulb	None	Several large	Diploic	Right petrous tip pneumatic, the cells of this tip ending blindly over the jugular bulb not communicating with the middle ear or mastoid; left petrous apex nonpneumatic; both mastoids diploic
11. Male, colored, age 37, right	Few small	Few small	Few small	Few small	Many large	Many large	Few large	Many large	Pneumatic	Well developed cell channels, no supracochlear, two infracochlear; principally a posterior infracochlear channel communicating with the mastoid process at a point 1.2 cm. below the beginning of the vertical portion of the 7th nerve; a few small anterior surface cells, few fine dehiscences on the anterior surface of the petrous pyramid 4 mm. in front of the genu
12. Same, left	Few small	Few small	Few small	Few small	Many large	Many large	Few large	Many large	Pneumatic	Same as preceding specimen
13. Male, white, age 72, right	Many moderate sized	Many moderate sized	None	Many moderate sized	Many moderate sized cells end blindly over the jugular bulb	None	Many large	Many large	Nonpneumatic except for a few cells in Trautmann's triangle	Well developed cell channels, two supracochlear, one infracochlear, more pneumatization in petrous apex than in mastoid
14. Same, left	Many moderate sized	Many moderate sized	None	Many moderate sized	Same	Many large	Many large	Same	Same	Same as preceding specimen
15. Male, colored, age 40, right	Few large and many small	Very few small	Few small	Few small	Few moderate sized	Several moderately large	Several small	One large	Pneumatic	Well developed cell channels, one supracochlear and one infracochlear
16. Same, left	Few large and many small	Very few small	Few small	Few small	Few moderate sized	Several moderately large	Several small	One large	Pneumatic	Same as preceding specimen

TABLE 3.—*Analysis of 22 Pneumatized Petrous Portions of the Temporal Bone—Concluded*

Specimen	Supracochlear Cells			Infracochlear Cells			Petrous Tip Cells		Type of Mastoid Process	Observations: Cell Channels and Other Data
	(1) Anterior Surface Cells	(2) Superior Border Cells	(3) Posterior Surface Cells	(1) Anterior to Cochlea	(2) Subcochlear	(3) Posterior to Cochlea	(1) Supracarotid	(2) Infracarotid and Posterior to Carotid		
17. Male, colored, age 72, right	Many small and few large	Few very small	Few small	Two very small	Few very small	Few small	One large	One large	Pneumatic	Well developed cell channels, one supracochlear, no infracochlear; one large cell above and lateral to carotid filled nearly whole apex; dye introduced into apex came out of the mastoid cells
18. Same, left	Many small and few large	Few very small	Few small	Two very small	Few very small	Few small	One large	One large	Pneumatic	Same as preceding
19. Male, white, age 33, left	Many moderately large	Few small	Few moderately large	None	Few very small	Few small	Several large	Few small	Right and left diploic	Well developed cell channels, two supracochlear, no infracochlear; one group of cells ending in a large culdesac in the posterior superior angle of the petrous apex about 0.6 cm. from the 6th nerve and 0.7 cm. from the tip; on the anterior surface of the apex, a group of cells went down to the tip of the apex; only a thin partition of bone lay between this culdesac and the group of cells going to the tip; very thin cortex over the anterior surface of the pyramid; right petrous apex nonpneumatic
20. Male, colored, age 34, right	Few moderate sized	None	Few moderate sized	None	Few small	Few small	Few moderate sized	Few moderate sized	Pneumatic	Well developed cell channels, two supracochlear, no infracochlear; petrous apex of opposite side nonpneumatic; both mastoids pneumatic
21. Male, white, age 50, right	Few moderate sized	None	None	None	None	None	Few moderate sized	None	Pneumatic	Well developed cell channels, one supracochlear, no infracochlear; half dozen small cells on anterior surface of the petrous above the carotid which communicates with the middle fossa
22. Same, left	None	Few small	Few moderate sized	None	Few very small	Few very small	Few moder ate sized	Few moderate sized	Pneumatic	Same as preceding specimen except for posterior superior channel of cells in anterior superior channel leading from the mastoid to the apex

cells were further subdivided into: (1) anterior surface cells, (2) superior border cells and (3) posterior surface cells. The infracochlear cells were further subdivided into: (1) cells anterior to the cochlea, (2) subcochlear cells and (3) cells posterior to the cochlea.

We have considered the cells of the petrous apex under a separate heading as they were not a part of any one grouping of cells. The cells in the region of the petrous apex were classified according to their relation to a plane represented by an arbitrary line drawn through the superior edge of the horizontal portion of the carotid artery. By this line the cells of the petrous apex were subdivided into: (1) supracarotid cells and (2) cells posterior and inferior to the carotid. It was noticed that a pneumatized petrous pyramid is definitely wider than one that is not pneumatized, especially in the region of the apex. In the pneumatized bone this area assumes a rather quadrilateral appearance as compared with the triangular aspect of the nonpneumatized bone.

In some specimens the arrangement of the cells in the petrous apex is such that they fall short of reaching the tip. These cells are the same as those spoken of by Ramadier [2] as culdesac cells.

In specimen 34 the petrous pyramid was pneumatized and its tip cell had a floor as thin as tissue paper. In this type of bone a retropharyngeal abscess could easily result from an infection in the petrous apex.

In a few specimens we found anterior surface cells lying above the plane of the cochlea and in relation to the roof of the carotid canal. These cells led to the petrous apex. The carotid artery exists in its anatomic position long before the pneumatic cells which are adjacent to it appear. Therefore the inference that these cells are a part of the carotid canal appears erroneous. The fact is that they are the end-result of the pneumatization process to which the bone has been subjected during its growth and development. This statement is made because of the fact that in 178 nonpneumatized bones, varying from that of a 7 month fetus to that of a person 89 years of age, no cells were seen in the carotid canal. This is also borne out by the fact that not a single pneumatized petrous pyramid was encountered in 28 petrous bones of infants under 1 year of age. Only when the age of 15 was reached was a diplosclerotic type of bone seen in this series. We have not observed pneumatized cells leading into the apex from the arch of the superior semicircular canal. In only 2 specimens (table 3, nos. 5 and 6) did we encounter in the peritubal area cells which led to the petrous apex. This absence of the peritubal cells leading to the apex is in agreement with the findings of Mouret.

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2. Ramadier, J.: L'ostéite profonde du rocher, Ann. d'oto.-laryng., 1931, p. 1300.

The structure of the petrous apex may be one of three types. Red bone marrow may be present with no pneumatization whatever. This is seen especially in young children. The other extreme is a sclerotic bone with no marrow. Between these two is the mixed type of diploic cells and red bone marrow. We have also seen a well pneumatized petrous tip associated with red bone marrow (table 3, no. 3); the entire tip was replaced by a single large cell.

Gross sections along the longitudinal and transverse axes of the petrous bone were made. Roentgenographic studies were carried out on the whole bones to demonstrate groupings of cells. The cell channels were further recognized by the introduction of a dye into the apex and

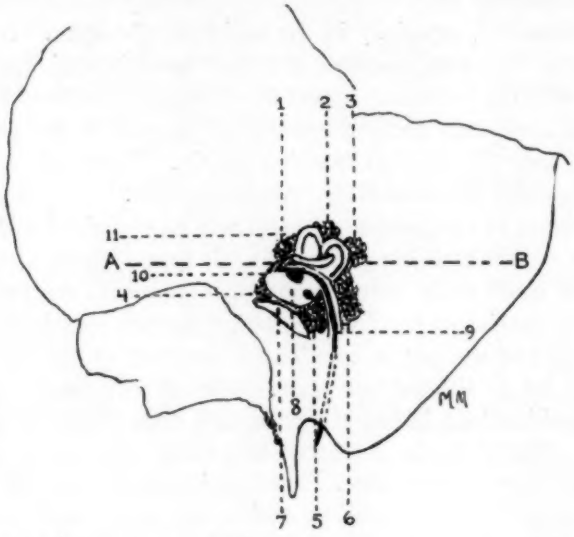

Fig. 1.—Semidiagrammatic drawing illustrating the arrangement of the cells: *A-B*, arbitrary line separating the supracochlear and the infracochlear groups of cells. *1*, anterior surface cells; *2*, superior border cells; *3*, posterior surface cells; *4*, cells anterior to the cochlea; *5*, subcochlear cells; *6*, cells posterior to cochlea; *7*, carotid canal; *8*, cochlea; *9*, facial nerve; *10*, point of contact of the cochlea with the petrous pyramid; *11*, point of contact of the superior canal with the anterior surface of the petrous pyramid.

by observation of the course of exit of the dye. In 46 well developed channels the majority fell into two groups; 16 were in relation to the jugular bulb and 14 in the anterior surface group. The preponderance of this type of cell arrangement agrees with Mouret's findings. The anterior surface group originates in the angle between the superior semicircular canal and the facial nerve.

The measurements from the superior semicircular canal to the apex tip varied from 1.1 to 4.5, the average being 3.2 cm.

The measurements from the internal edge of the internal auditory meatus to the apex tip (petrous tip) varied from 0.5 to 3.5, with an average length of 2.2 cm.

The largest tip in the collection, which was 3.5 cm. in length, occurred in a white man 60 years of age. This tip was sclerotic, whereas the tip recorded by Mangabeira-Albernaz [3] was pneumatized. In his specimen the tip measured 2.9 cm. in length.

TABLE 4.—*Analysis of Well Developed Channels to Petrous Apex*

Supracochlear	
(1) Anterior surface	14
(2) Superior border	7
(3) Posterior surface	7
Infracochlear	
(1) Anterior to cochlear	2
(2) Subcochlear (jugular bulb route)	7
(3) Posterior to cochlear (jugular bulb route)	9

TABLE 5.—*Comparison of Bony Structure of Temporal Bone in Different Series*

	Mastoid Process				Petrous Bone			
Author, Number of Specimens	Pneumatic	Diploic	Mixed	Nonpneumatic	Pneumatic	Diploic	Mixed	Nonpneumatic
Zuckerkandl (quoted by Betinoff and Balan), 250	36.8%	20%	43.2%	....	Not done			
Belinoff and Balan (Monatschr. f. Ohrenh. **64**: 1185, 1930), 40	.....	....	.....	....	35%	22.5%	42.5%	
Glick (Ann. Otol., Rhin. & Laryng. **42**: 175, 1933), 42	.....	....	.....	....	19%	.....	9.5%	71.5%
Myerson, Rubin and Gilbert, 200 mastoids, 200 petrous bones	38%	25%	7%	30%	11%	11%	6.5%	71.4%
Girard (Atlas di anatomie, chirurgie et de technique opérative du labyrinthe, ed. 2, Paris, Norbert Maloine, 1914, chap. 1)	Not mentiond				Combined, 30%			70%

TABLE 6.—

Sex, Color	Age	Mastoid	Petrous Bone
Female, colored	24	Sclerotic	Diplosclerotic
Male, white	33	Right: diploic Left: diploic	Right: nonpneumatic Left: pneumatic (table 3, no. 19)
Female, white	50	Diplosclerotic	Diploic
Male, white	72	Pneumosclerotic	Pneumatic (table 3, nos. 13 and 14)
Female, white	85	Right: diploic Left: diploic	Right: pneumatic (table 3, no. 10) Left: nonpneumatic

One would expect the cellular structure of both petrous pyramids to be the same in a given skull. While this appears to be the case generally, our series demonstrates that there are exceptions. In 4 of the 100 skulls studied the petrous apex was found pneumatized on one

3. Mangabeira-Albernaz, P.: Grande cellule pneumatique du rocher; contribution à la pathogénie du syndrome de gradenigo, Arch. internat. de laryng. **35**: 1034 (Nov.) 1929.

side and not pneumatized on the other. Greater pneumatization of the petrous apex than of its corresponding mastoid process was found as is shown in table 6.

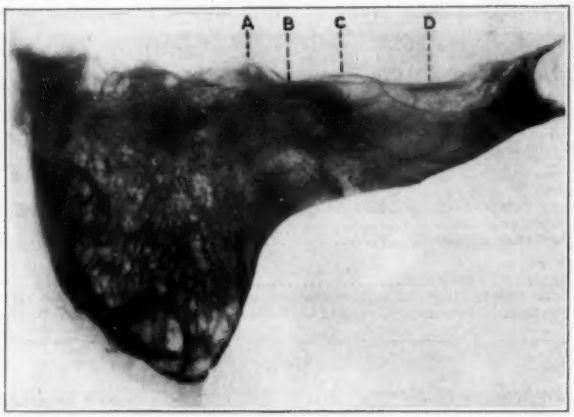

Fig. 2.—Roentgenogram of a pneumatized mastoid process and petrous pyramid, illustrating the elevations and depressions. *A* elevation; *B*, depression; *C*, elevation; *D*, depression.

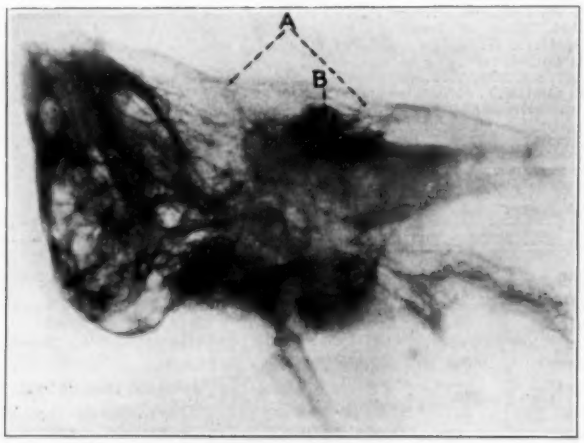

Fig. 3.—Roentgenogram showing well developed supracochlear pneumatized cell channels (table 3, no. 1): *A*, supracochlear channels; *B*, cross-section of the superior semicircular canal.

In 54 specimens from colored persons 11 petrous pyramids, or 20.3 per cent, were pneumatized. In 146 specimens from white persons, 11 petrous pyramids, or 7.6 per cent, were pneumatized. In this series there was a much greater percentage of pneumatized petrous pyramids in the

skulls of Negroes. In 54 specimens from colored persons, there were 4 diploic petrous pyramids, or 7.4 per cent, while in 146 specimens from white persons, there were 18, or 12.3 per cent.

In 2 specimens which showed pneumatized petrous apexes the cell channels stopped blindly so that there was no communication with the middle ear or mastoid process. This pneumatization was in the floor of the petrous pyramid posterior to the carotid artery.

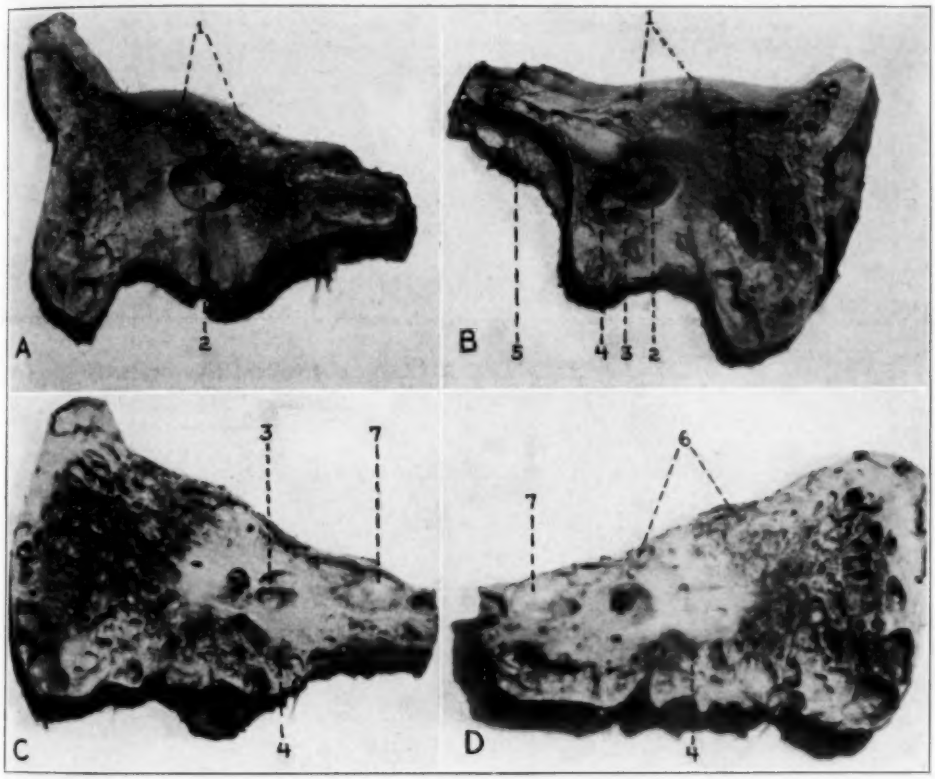

Fig. 4.—Photographs of sections of pneumatized bone, from *A*, most anterior to *D*, most posterior section: *A1*, anterior surface cells of the supracochlear channel; *A2*, middle ear cavity; *B1*, anterior surface cells; *B2*, middle ear cavity; *B3*, promontory of the cochlea; *B4*, subcochlear cells; *B5*, carotid canal; *C7*, apex tip; *C3*, cochlear; *C4*, subcochlear cells; *D7*, apex tip; *D4*, subcochlear cells; *D6*, superior border cells.

LANDMARKS

In all but 2 of the petrous pyramids we found the following arrangement to be constant: When the anterior surface of the petrous pyramid was studied we encountered the following sequence of landmarks along its superior border: an elevation, a depression, a second elevation and a second depression. The structures responsible for these landmarks

are as follows: The first elevation is an eminence above the superior semicircular canal; the first depression is situated between the eminence above the superior semicircular canal and the external lip of the internal auditory meatus. Posteriorly it corresponds with the subarcuate fossa. Anteriorly it marks the location of the beginning of the greater superficial petrosal nerve as it leaves the genu of the facial nerve. The

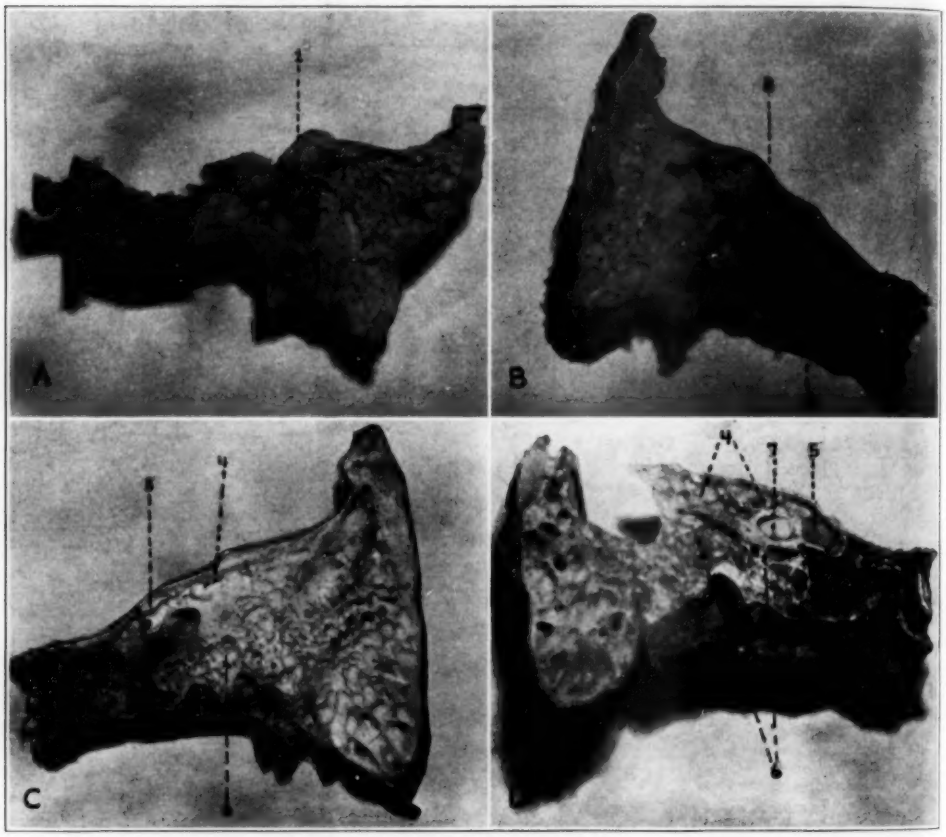

Fig. 5.—Photographs of sections of pneumatized bone, from *A*, most anterior to *D*, most posterior section: *A*, most anterior section showing *1*, malleus in drum membrane; *B2*, cochlea; *B3*, carotid canal; *C4* and *5*, superior border cells; *C6*, subcochlear cells; *D4*, superior border cells; *D5*, petrous tip cell; *D6*, subcochlear cells; *D7*, internal auditory meatus.

second elevation consists of the upper lip and roof of the internal auditory meatus; the second depression is the petrous apex. We have taken advantage of this sequence of landmarks in planning our technic for uncapping the petrous apex by an approach through the middle fossa (fig. 2).

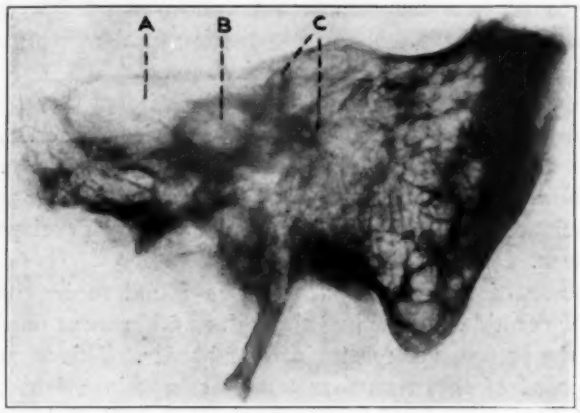

Fig. 6 (table 3, no. 17).—Roentgenogram of pneumatized petrous bone of a colored man, aged 72; *A*, large petrous tip cell; *B*, cochlea; *C*, superior and horizontal semicircular canals.

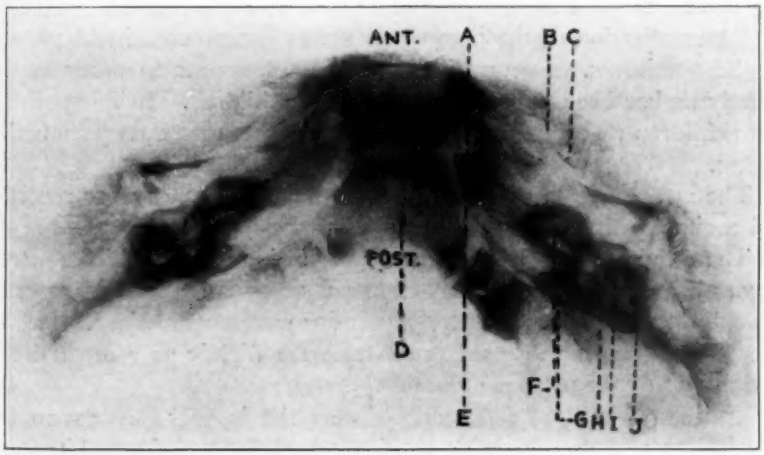

Fig. 7.—Roentgenogram of a section of the base of the skull of an infant, aged 5 months (both petrous pyramids are shown): *A*, foramen lacerum medium; *B*, foramen ovale; *C*, foramen spinosum; *D*, basioccipital bone, anterior rim of foramen magnum; *E*, petrous tip; *F*, cochlea;; *G*, internal auditory meatus; *H*, posterior semicircular canal; *I*, superior semicircular canal; *J*, external semicircular canal.

The foramen spinosum through which the middle meningeal artery emerges is found on a line with the internal lip of the internal auditory meatus in each specimen. The third division of the fifth nerve can be seen 2 mm. internal to the foramen spinosum.

The groove for the superior petrosal sinus is not constant and may be found on the anterior surface near its superior border. At times it is seen on the posterior surface near the superior edge. In most instances, however, it is to be found at the juncture of the anterior and posterior surfaces. In some specimens it is poorly developed and can barely be seen.

The course of the carotid artery was found to be constant. In cadavers the carotid artery shines through as a blue area on the anterior surface of the petrous apex at its inferior border. This area was found to be composed of thin transparent bone except in a few instances in which the bone was replaced by fibrous tissue. In 2 of the pneumatized specimens there were about six small pin-point dehiscences in the plate covering the carotid artery.

COMMENT

A series of 200 petrous portions of the temporal bone were studied. These bones were obtained from the skulls of 100 persons ranging in age from 7 months of fetal life to 89 years.

Pneumatization of the petrous apex was encountered in 11 per cent of the specimens. Pneumatization does not appear to occur as frequently as has been supposed, especially in children. In 36 specimens from children up to and including 7½ years there were no pneumatized apexes.

The arrangements of cells of the pneumatized bones were recorded, and a simplified grouping of the cell channels is offered.

The cellular structure of the mastoid portion and that of the petrous is not always the same. Thirty-eight per cent of the mastoid processes but only 11 per cent of the petrous portions were pneumatized. Twenty-five per cent of the mastoid processes were diploic as compared with 11 per cent of the petrous pyramids.

The best developed cell channels were the jugular bulb group (the subcochlear and the posterior cochlear) and the anterior surface cells above the cochlea.

In 4 of the 100 skulls the petrous apex was pneumatized on one side and not on the other.

In this series there was a greater incidence of pneumatization in the skulls of colored than in those of white persons.

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Clinical Notes

THE COPPER MOLDED SPLINT: A NEW METHOD OF APPLICATION

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After experimenting for the past ten years with various types of appliance for the immobilization of the fractured nose I have finally arrived at a method which in my experience has proved safe and dependable. The molded copper splint is not original with me; it was suggested years ago by Lee Cohen of Baltimore and since then has been mentioned from time to time in the literature. At first I found several disadvantages in the copper splint, most of them having to do with the difficulty of keeping the splint in place. The plan, as I have worked it out, takes care of this problem satisfactorily and at the same time provides for a greater degree of comfort for the patient.

The method of making and applying the splint is as follows: The sheet copper used must be light enough to be readily bent with the fingers. If it is too stiff it will be difficult to mold it accurately to the nose, and necrosis may follow from the pressure of ridges that cannot be readily smoothed out. Figure 1 shows several stages in the making of a splint. The outline of the area to be covered by the splint is shown on the plaster cast in the center (*5*). It will be noted that the splint not only covers the nose but extends outward on the cheeks to the malar prominences. This is necessary so that the splint will not rest directly on the bridge but rather on the superior maxillae. In this way there is no danger of depressing the fragments of a fractured nose and causing the deformity to recur. The object of the splint is to hold the nose in the midline and prevent lateral displacement.

A pattern is first made of paper directly from the patient according to the outline shown on the cast. The copper is then cut to the pattern and is covered on both sides with broad adhesive tape, which is trimmed to the edges of the copper. The splint is then bent in the midline and molded with the fingers over the patient's nose until it fits closely. Particular attention must be paid to the following points:

The flare of the splint must rest just below the malar prominences; the sides of the splint must hug the sides of the nasal bridge closely; the apex of the triangle must not rest directly on the summit of the nasal bridge but must be several millimeters above it. (An ordinary metal probe or groove director should be passed between the splint and the nasal bridge to make sure of this point.) The upper margin of the flared portion must not reach higher than the inferior orbital borders. A single layer of cotton lint is cut slightly larger than the splint and applied to its inner surface to serve as a pad (fig. 1, *4*).

The next step is to attach a strip of adhesive tape about ½ inch (1.27 cm.) wide and from 3 to 4 inches (from 7.62 to 10.16 cm.) long to the inside of the angle of the splint so that the free end hangs below when the splint is first applied. This step is shown in figure 1, *6*, and in figure 2. A long piece of adhesive tape about 2 inches (5.08 cm.) wide is folded on itself in three layers so that no

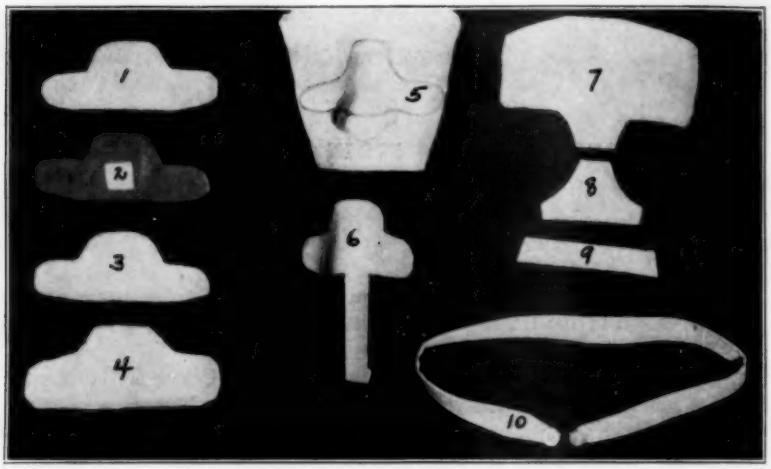

Fig. 1.—*1*, paper pattern taken on patient's nose; *2*, sheet copper cut to the pattern; *3*, copper splint covered with broad adhesive tape; *4*, cotton lint slightly larger than the splint for padding; *5*, plaster model showing the area to be covered by the splint; *6*, splint bent approximately to the shape of the nose; "pull-up" strip of adhesive tape attached to the inner side of the angle; *7*, broad adhesive strip to fix the "pull-up" strip on the forehead; *8* and *9*, additional adhesive tape described in the text; *10*, folded band of adhesive tape with pearl buttons sewed to the ends.

Fig. 2.—Splint molded to the nose: A band of folded adhesive tape drawn around from the back of the neck holds the splint in place by a rubber band attached to buttons. A "pull-up" strip of adhesive tape hangs from the inner surface of the splint.

adhesive surface is exposed. This strip is passed around the patient's neck from behind forward passing just below the auricles and is cut to such a length that the ends fully cover the lateral flanges of the splint. An ordinary pearl button is then sewed to each end. This long strip is shown in figure 1, *10*, and in figures

Fig. 3.—The "pull-up" strip has been carried upward, attached to forehead and fastened by broad adhesive tape previously cut to shape.

Fig. 4.—Two small pieces of adhesive tape (*8* and *9* in figure 1) applied, securing the "pull-up" strip to the splint.

2, 3 and 4 it is shown in place. A double rubber band connects the two buttons over the summit of the splint and holds it firmly against the face. The advantage of the rubber band lies in the fact that it maintains an even pressure and allows for the differences of tension which occur when the head is bent forward or backward or when the jaw is opened or closed. The loose end of adhesive tape hanging from the inside of the splint is pulled upward above the rubber bands,

carrying the splint with it until its upper end rests securely against the glabella. This strip is fastened to the forehead in the midline and secured by a broad piece of adhesive tape covering the entire forehead and cut so as to come down over the glabella (fig. 1, *7*). At this point it will be noted that the "pull-up" strip stands away from the splint on a line with the interior canthi. The final piece of adhesive tape, fig. 1, *9*, is then applied, bringing this "pull-up" strip down to the splint and thus making for a snug fit. Figure 1, *9* shows an additional strip of adhesive tape, applied just below the rubber band to prevent its slipping downward.

When thus applied the splint will remain undisturbed for two or three days. It may be removed and replaced at intervals of two or three days over a period of from ten days to two weeks, or until one is satisfied that the broken bones are uniting. It will be noted that the pull of the rubber bands as well as the action of the lower jaws tends to pull the adhesive tape from the forehead; therefore it is necessary to replace this tape every two or three days. Also, the frequent replacement of the splint permits inspection for local reaction and admits tighter adjustment as the swelling diminishes.

Recently I have used this splint in treating most of my patients with fractures and all those with refractures, and have used it as a postoperative dressing (for twenty-four hours) in the removal of humps, and in other subcutaneous rhinoplasty on the nasal bridge. I have found it eminently satisfactory in the treatment of all fractures except massive depressed fractures or those in which there are extensive external lacerations. In such cases I frequently resort to an intranasal splint attached to a head cast.[1]

1. Salinger, S.: Treatment of Nasal Fractures by New Adjustable Splint, Ann. Otol., Rhin. & Laryng. **33**:413 (June) 1924; Adjustable Splint for Fracture of Nose, Illinois M. J. **48**:304 (Oct.) 1925.

A COMBINED AIR AND BONE CONDUCTION TEST FOR PRETENDED DEAFNESS

B. M. Becker, M.D., Brooklyn

The various tests devised for unmasking simulated monaural deafness are of either the air conduction or the osseous conduction type. While both methods are frequently employed in testing the hearing capacity of the same person they have not been used simultaneously.

The sources of sound utilized in these tests are: (1) the human voice; (2) tuning forks; (3) ticking instruments, as a watch, clock or metronome; (4) clicking instruments or objects, as Politzer's acoumeter, coins or any other metallic substances which, when struck together, emit a clanking sound; (5) musical instruments, and (6) electric apparatus.

The voice would be the most useful source of sound for testing purposes if it were not for the many drawbacks which render it impracticable. The voice is variable in quantity and quality. The volume cannot easily be gaged or controlled. The composition of speech is such that its essential elements vary greatly in capacity to transmit sound. Thus, speech does not readily lend itself to testing.

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Tuning forks are the most useful and practical instruments for the various tests of functional hearing. They are uniform in quantity and quality. They are accurately graded. They are easily manipulated. They lend themselves readily to tests of air and bone conduction.

Some tests are cumbersome and inconvenient, requiring two or more persons to carry them out properly. Others require a number of forks, some of the same pitch and timing, while others need, in addition, specula, a stethoscope, an occlusion bandage, sealing wax or other obstructing material.

No single test devised for detection of malingering is so certain in its operation that a clever and intelligent malingerer may not, by repeated trial and continued practice under expert coaching, circumvent it, and thus nullify the best efforts of the examiner.

The new test to be described requires for its performance only a piece of soft rubber tubing and a medium pitched tuning fork. Occasionally another fork of the same pitch is needed, as will be explained subsequently.

The tubing is about 30 inches (76 cm.) long, with a bore about ¼ inch (0.6 cm.) in diameter. In one end of the tube an olive-shaped ear tip is inserted, and the opposite, free end is folded on itself, about 1 inch (2.5 cm.) from the opening and secured in this position by slipping over it a small rubber band. Thus a loop is formed at the free extremity of the tube. The loop must be of sufficient size to permit the stem of the fork used in the test to enter readily through it without exerting too much pressure on the walls of the tube, and at the same time the loop must not be loose enough to slip off the handle during its manipulations.

In carrying out this procedure two things are to be borne in mind: It is essential that the distal opening of the tube is tightly closed, so that when the fork is inserted through the loop and is set in motion none of the vibrations escape outward, thereby weakening the intensity of the sound. Second, it is essential that the lumen of the tube proximal to the fork (the airway of the tube leading to the ear) is not unduly compressed, either by winding the rubber band too tightly around it or by forcing the stem of the fork through too tight a loop, thereby interfering with the free passage of the vibrations to the ear and thus weakening the intensity of the sound.

Any standard fork with from 128 to 512 double vibrations, inclusive, may be used, but it is preferable to use one of the higher pitched forks (256 or 512) to avoid furnishing a clue to the shrewd simulator who may be sensitive to the vibrations of the lower pitched fork.

This test, unlike some others based on the difference in the intensity of sound between two objects as a result of their difference in distance from the ears, is founded on the well known fact that in normal audition hearing by air conduction is of greater intensity and duration than hearing by osseous conduction. Consequently when two forks of the same pitch and same timing are used on opposite sides of the head, one in front of the ear and the other on the mastoid bone, the sound conveyed by air will completely mask the sound transmitted by bone, so that one will be aware of hearing the sound only on the side of greater intensity (unilateral hearing).

When conduction by tube is compared with direct air conduction, the results are slightly in favor of the former, provided the test is carried out according to directions, namely, the complete closure of the free end of the tube and the exercise of a proper amount of pressure of the handle of the fork on the sides of the tube. Consequently when comparing conduction by tube with bone conduction, the results will be more marked than in a comparison of bone conduction and direct air transmission.

PROCEDURE

A careful and detailed history is taken. After an otoscopic examination of the supposedly involved ear it is subjected to the standard tests of air and bone conduction, which it is assumed give negative results. Next the unaffected ear is tested in the following manner: The examiner stands or sits back of the patient. Setting the fork chosen for this test in maximum vibration, he applies its handle to the mastoid bone of the normal ear. The patient is directed to raise the index finger of the hand on the same side on which he hears the sound and to lower it as soon as the sound dies away. This test for bone conduction is repeated two or three times, and the average duration of the patient's hearing time, marked in seconds, becomes the denominator of a fraction. Then the normal ear is tested for air conduction. The ear tip of the rubber tube is snugly inserted into the canal of the normal ear, and with its stem through the loop the fork is set in vigorous motion. The patient is instructed to raise his finger on the side on which he perceives the sound and to drop it when the sound is no longer heard. After two or three trials the average length of hearing time by tube conduction becomes the numerator of the fraction.

It will be found, by trial, that the numerator of the fraction bears a ratio to the denominator of 2 or 3:1, that is, the hearing time by tube conduction will be two or three times as long as that by osseous conduction, depending on the fork used. If after two or three trials it is found that the hearing time by bone and tube conduction tend to approximate, owing to conductive deafness or to some peculiarity of bone structure on the side tested, I then reenforce the sound through the tube by bringing another fork of the same pitch in contact with the tube close to the tested ear, and note the results.

After ascertaining the duration of perception of sound by bone and by tube conduction and marking the results, one is ready to proceed with the test proper. To conduct the test one should insert the fork through the loop at the free end of the tube, place the ear piece in the canal of the "deaf" ear, strike the fork vigorously, set its stem on the mastoid bone of the opposite (normal) ear and direct the patient to raise his finger on the side of sensation of sound and lower it as soon as the sound becomes imperceptible. His finger is then watched, for if he is malingering it will betray him.

In performing this test, it is essential to insert the ear tip before setting the fork in motion and not to place the vibrating fork on the mastoid bone first, thus giving the patient an inkling that there is production of sound in the normal ear.

COMMENT

A patient may present himself complaining of total deafness in the right ear. After completion of the tests of the right ear, with negative results, the preliminary examination of the normal ear with the technic outlined should be performed. The malingerer will hear the sound intensely in the right ear and no sound at all in the left ear, owing to the fact that the greater intensity of sound coming through the tube will completely mask the sound coming from the mastoid bone on the opposite side. He may automatically make a gesture to raise his right finger (having been directed to raise the finger on the side of the sound) thereby throwing some doubt on his sincerity. Hearing the sound only in the right ear puts the simulator in a difficult position. He dare not raise his right finger, for that would be betraying himself. He cannot raise the left finger, for he hears no sound on the left side. If he does not raise a finger he stands condemned as a malingerer.

The reason for this is that if his right ear was really deaf he would hear the sound of the fork on the left side by bone conduction.

If he does raise the left finger after some hesitation, I mark the length of time the finger remains in an indicative position. If the time in seconds that the finger is held up corresponds to the numerator of the fraction obtained in the preliminary testing he again betrays himself as an impostor. One who is really deaf in the right ear will not hesitate in raising his left finger, and the duration of perception of sound marked in seconds will invariably correspond to the denominator of the fraction obtained by striking an average in several trials. If he is a shrewd malingerer the patient may have taken note in the preliminary testing of the difference in duration of time between bone and tube conduction, and he may on this account drop his finger before the sound stops. He thereby creates the impression that his hearing of the sound does not depend on tube conduction. In this event repetition of the test will ultimately expose him, for he can never maintain uniformity in his responses as to time. The duration of his hearing will vary more or less and will fall somewhere between the numerator and the denominator, but never at the same point.

In order to check the patient's veracity when his left finger is raised and the diagnosis is inconclusive I resort to a test of the two forks to confirm the diagnosis. This is performed in the following manner: With the ear tip in the same position and the stem of the fork in the loop, the examiner strikes another fork of the same pitch and timing and brings it in contact with the walls of the tube, at the same time placing the first fork, which is at rest, on the mastoid bone of the normal ear. As before, on hearing the sound of the fork in the right ear and not in the left, but knowing by the presence of the fork on the bone of the left ear that there must be production of sound on the left side, the patient will, in order to be consistent, again raise his left finger and thereby betray himself. The true sufferer from total deafness in the right ear would not raise a finger under these conditions, for, the right ear being deaf, he would not perceive sound there, and, the fork on his left mastoid bone being inert, he would not be sensible of sound in the left ear.

As a reversal of the process I pinch or clamp the tube anywhere along its course and then apply a vigorously vibrating fork to the left mastoid. The patient is directed to raise his finger only if he discerns any change in sound. I then unclamp the tube. If he raises his finger indicating an alteration in the sound, he betrays himself, for a truly deaf person will notice no change. If he does not raise his finger, I pinch the tube again, and if his finger still remains unraised he likewise proves himself a malingerer.

RÉSUMÉ

In applying the test certain signs will almost surely disclose the malingerer:

1. A gesture to raise the right finger tends to cast suspicion on the patient's veracity.

2. Failure to raise either finger stamps him as a malingerer.

3. If he raises the left finger but lowers it synchronously with the cessation of sound in the right ear he is betrayed as a simulator.

4. Lowering of the left index finger before the cessation of sound in the right ear, but with marked variability on several trials, is proof of pretended deafness.

5. Raising of the left finger when the inert fork rests on the left mastoid bone and the handle of a second vibrating fork is brought in contact with the wall of the tube is positive evidence of feigned deafness.

6. Raising of either the right or the left finger as a sign of a change in sound in the "reversal test" betrays malingering.

7. Hesitancy on the part of the patient as to which finger to raise puts him under the suspicion of simulating deafness.

CONCLUSION

This test, if properly carried out, cannot fail to detect simulated deafness in the most astute malingerer. It is simple in operation and execution. It can be manipulated readily by one person; in fact, it leaves the examiner's right hand free. It requires only a piece of tubing and a tuning fork, or occasionally a second fork. While to the examiner it is a simple test, to the malingerer it is confusing and complex, thus giving it greater reliability than other tests.

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Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

THE PARANASAL CAVITIES

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ASSISTED BY
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ANATOMY AND PHYSIOLOGY

Wasson [1] presents a roentgen study of the changes in the nasal sinuses after birth to determine at what time the sinuses become fully aerated and what influence this might have on subsequent events with reference to the respiratory tract. He concludes that, in general, the antrums and the ethmoid sinuses of an infant do not become fully aerated until from four to eight weeks after birth and that the state of aeration is an important influence on the condition of these sinuses during the first two years of life.

Eckert-Möbius [2] presents a comparative study of the nasal accessory sinuses in man and in mammals. With regard to the function of the accessory sinuses, the author rejects the idea that they play any part in the improvement of the sense of smell or that they have arisen to reduce the weight of the skull. He feels, moreover, that the sinuses did not arise as a response to adjustments necessary for the spacing of the teeth and insertion of the muscles of mastication. Their one function is to help warm and moisten the inspired air. Air sinuses have developed in the large and quickly moving mammals with an active respiration (elephant, giraffe and buffalo), while the slow moving mammals, especially if they live in a watery medium where the inspired air does not require moistening (hippopotamus and walrus), have only rudimentary accessory sinuses or none at all. Numerous illustrations accompany the paper.

In order to arrive at a satisfactory explanation for the frequent occurrence of paralysis of the abducens nerve associated with disease of the sphenoid sinus, Houser [3] studied minutely the exact course of the

1. Wasson, W. W.: Changes in the Nasal Accessory Sinuses After Birth, Arch. Otolaryng. **17**:197 (Feb.) 1933.

2. Eckert-Möbius, A.: Comparative Study of the Nasal Sinuses in Man and in Animals, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **134**:287, 1933.

3. Houser, K. M.: Infection of the Sphenoid Sinus as a Possible Cause of Abducens Paralysis, Pennsylvania M. J. **36**:411 (March) 1933.

sixth cranial nerve in the skull and measured in 19 wet specimens from adults the exact distance between the bony floor of Dorello's canal, through which the nerve passes, and the nearest point of the interior of the sinus. A clear description of the course of the nerve from the brain stem to its entrance into the orbit is given in the paper. The author's explanation of the more frequent involvement of the abducens nerve as compared to the involvement of the third or the fourth nerve is that the sixth nerve alone travels through the firm boundaries of Dorello's canal and is therefore more easily compressed.

Measurements from the interior of the sinus to Dorello's canal are clearly tabulated. The author found great variations in the specimens examined. The shortest distance was 2 mm.; the longest, 22 mm.; the average on the right, 8.3 mm., and on the left, 7.7 mm. As a rule, the distance on one side varied no more than 4 mm. from the other. Of the 38 specimens examined, 2 measured 2 mm., 4 measured 3 mm. or less, 8 measured 4 mm. or less and 11 measured 5 mm. or less. The author ends his paper by speculating on what could be considered the distance of vulnerability of the nerve. The paper is worthy of careful perusal.

In a roentgenographic study of 9 cases of homolateral atrophy of the cerebrum, Dyke, Davidoff and Masson [4] found a thickening of the skull and an enlargement of the air sinuses on the corresponding side. The cerebral atrophy may be from any cause such as trauma at birth or infection. As a result of the atrophy of the brain, a localized shrinkage within the skull takes place on that side. In an effort to make up for the loss of substance within the skull, the homolateral ventricle enlarges, the brain is displaced toward the affected side, the inner layer of the skull becomes thickened, and the ethmoid and frontal sinuses on the same side take on an additional growth. The mastoid cells on the homolateral side also develop a greater pneumatization. The 9 cases are carefully illustrated with roentgenograms and encephalograms of the skull.

Simon [5] studied the anatomy of the maxillary antrum by means of the antroscope placed in the inferior meatal route and also through the canine fossa (i. e., facial wall) in an effort to determine the route through which one could see more within the sinus. He feels that the instrument is at fault and that with a new kind one could see more. The maxillary ostium can be seen more frequently by puncture through the facial wall of the sinus. The author found the medial

4. Dyke, C. G.; Davidoff, L. M., and Masson, C. B.: Cerebral Hemiatrophy with Homolateral Hypertrophy of the Skull and Sinuses, Surg., Gynec. & Obst. **57**:588 (Nov.) 1933.

5. Simon, E.: Antroscopy and Its Relation to Anatomy of the Maxillary Sinus, Ann. Otol., Rhin. & Laryng. **42**:198 (March) 1933.

lateral dimension of the maxillary ostium to be 4.44 mm. He feels that the ostium should be called the infundibulomaxillary canal rather than the maxillary ostium. The canal has a variable direction and flows from the infundibulum into the antrum, usually in an anterior direction.

Nemours [6] conducted experiments on 6 rabbits by injecting pilocarpine intravenously, thus stimulating the parasympathetic system. The mucosa of the maxillary sinus was removed at varying intervals following the injections. It was found that a maximum eosinophilia occurred in approximately five minutes and disappeared in twenty-four hours.

The author also studied experimentally the effect of trauma and exposure of the mucosa of the maxillary sinus of rabbits in relation to increased eosinophilic response. Five rabbits were used in the series. The antrums on one side were exposed and traumatized, and the skin was sewed back. The antrums not operated on were used as controls. At varying intervals the animals were killed, and the mucosa was examined. It was found that a slight infiltration of eosinophils occurred in one-half hour after operation and a large increase in ten hours. The mucosa of the control sinuses contained no eosinophils.

A series of experiments was instituted by McMahon [7] in an effort to determine the phagocytosis of particulate matter in the mucous membrane of the nose and sinuses of the rabbit. India ink was injected into the antrum of the animal, and the mucous membrane was afterward studied histologically. It was found that the particles of carbon do not penetrate into the subepithelial spaces, and that the ciliated mucous membrane does not phagocytose the carbon. The author also found that the carbon within the antrum is phagocytosed by the free monocytes, young connective tissue cells and histiocytes, but not by the polymorphonuclear leukocytes. Particulate matter spreads through the subepithelial tissues of the mucosa of the antrum in four ways: (1) through the tissue spaces, (2) through the capillary lymphatics of the stroma, (3) through the perivascular lymphatics and (4) through the main lymphatics. Other experiments with drainage relative to the nasal mucosa are described.

LeMée [8] injected iodized poppy-seed oil 40 per cent into the nasal sinuses by the Proetz method, and subsequently recovered iodine in the urine, in an effort to determine the time necessary for elimination.

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6. Nemours, P. R.: Mucosa of the Maxillary Sinuses of the Rabbit: Production of Experimental Eosinophilia by Stimulation of the Nerve and by Trauma, Arch. Otolaryng. **17**:38 (Jan.) 1933.

7. McMahon, B. J.: Spread and Phagocytosis of Particulate Matter in the Nasal Mucous Membrane of the Rabbit, Ann. Otol., Rhin. & Laryng. **42**:660 (Sept.) 1933.

8. LeMée, J. M.: On Elimination of Lipiodol from the Nasal Sinuses, Ann. Otol., Rhin. & Laryng. **42**:712 (Sept.) 1933.

Care was taken that no iodized oil escaped into the pharynx or the larynx. The author found that the elimination of iodine was not very active but quite constant, varying with the amount of iodized oil used. However, in an inflamed mucosa the elimination is greater. The findings suggest that the Proetz method may be of therapeutic value in general conditions in which slow persistent iodine therapy is required.

A preliminary report on ventilation of the nose and accessory sinuses is contributed by O'Malley.[9] The author makes his studies with an oscillograph apparatus which consists of rubber tubing connected at one end to a cannula inserted into the antrum, and at the other end to a stretched membrane, which, through a movable arm, transfers the reading in the form of an oscillograph tracing on a revolving drum. Tracings are made under varying conditions such as closing one nostril, forced inspiration and expiration and blocking both nostrils. The author concludes that the air in the sinuses with patent ostia is in constant respiratory motion with that of the nose; that the variations in air pressure synchronize; that partial vacuum pressure in the sinuses can be demonstrated when no sinus disease exists, and that variations in air pressure can be shown in every part of the nasal passages.

Other interesting contributions dealing with the anatomy and physiology of the accessory sinuses are those by Israel and Nicholas,[10] Bleicher,[11] Piazza and Monteleone,[12] Rubaltelli [13] and Nilus and le Picard.[14]

PATHOLOGY AND BACTERIOLOGY

After an examination of many pathologic specimens removed from sinuses, Potts [15] states that infection in the nasal sinuses plays an important part in general systemic diseases. In fact, he feels that scarcely an organ in the body is unaffected. A detailed microscopic

9. O'Malley, J. F.: Ventilation of the Nose and the Accessory Sinuses: Oscillographic Method of Investigation, J. Laryng. & Otol. **48**:309 (March) 1933.

10. Israel, Sidney, and Nicholas, H. O.: Chemical Composition of Pus from Sinuses: Further Observations, Arch. Otolaryng. **18**:770 (Dec.) 1933.

11. Bleicher, M.: Veins of the Antrum in Man, Ann. d'oto-laryng., 1933, p. 288.

12. Piazza, A., and Monteleone, G.: Further Contribution on Pharyngo-Sphenosellar Anatomic Relations, Boll. d. mal. d. orecchio, d. gola, d. naso **51**:344 (Aug.) 1933.

13. Rubaltelli, E.: Anatomicopathologic and Histofunctional Researches on the Ethmoidal Mucosa of Persons with Anaphylactic Bronchial Asthma, Arch. ital. di otol. **44**:77, 1933.

14. Nilus, F., and le Picard: Anatomy and Dimensions of the Sphenoid Sinus in Man and in Various Vertebrates, Rev. franç. d'endocrinol. **11**:97 (April) 1933.

15. Potts, J. B.: A Discussion of Cardiac, Pulmonary and Other General Conditions Secondary to Chronic Nasal Sinus Infection, Ann. Otol., Rhin. & Laryng. **42**:1002 (Dec.) 1933.

description of pathologic membrane from a sinus is described in which frequent discrete abscesses, varying in size from that of a pinhead to that of a bean, are found scattered throughout. Bacteria are also found through the membrane. Complete but gentle removal of all diseased membrane is advised. As a source of infection, the author contends that pus found within the sinus is relatively unimportant. The focus is situated within the membrane itself.

Schütz [16] examined specimens of mucosa taken from 50 antrums. In 4 of these he found metaplastic changes of the columnar epithelium into stratified squamous and undifferentiated (basal cell) types. He believes that genuine metaplasia of the epithelium can take place, and calls it protoplastic metaplasia. He considers such a metaplasia to be a precancerous condition, the resulting foreign epithelium forming the "matrix" for carcinoma. Of the 4 specimens mentioned, 2 were from "normal" antrums, 1 from a mildly inflamed antrum and 1 from a case of severe purulent sinusitis.

Fenton and Larsell [17] feel that the presence of histiocytes in the mucous membrane of the sinuses is desirable as the first line of defense of the body against inflammation. In an effort to determine what substances might enhance this property, they experimented on cats by injecting various substances into the frontal sinuses, and afterward examined the mucous membrane. They found that local use of solutions of alkaline earth salts or hydroxides (calcium and magnesium) favors the mobilization of histiocytes in acute inflammation. Oily and colloid substances are destructive to epithelium and favor infection by impairing ciliary action, without any increase in the number of histiocytes.

The authors [18] also present a histopathologic and clinical interpretation of experimental sinusitis produced in cats. They feel that diets of varying chemical and vitamin content have little or no effect on the changes from acute to chronic sinusitis in these animals. The roentgen treatment of chronic experimental sinusitis seems helpful to the membranes that contain many lymphocytes, promoting histiocytic mobilization. In human membranes already fibrous or containing cysts or abscesses, the roentgen rays seem ineffective. In human subjects calcium therapy by mouth, intravenously and by irrigation seems to reduce edematous membranes, favors phagocytosis and increases the

16. Schütz, W.: Metaplasia of the Cylinder Epithelium in Carcinoma of the Antrum, Ztschr. f. Krebsforsch. **39**:152, 1933.

17. Fenton, R. A., and Larsell, O.: Experimental and Clinical Study of Histiocytes in Acute and Chronic Inflammation of the Nasal Accessory Sinuses, Laryngoscope **43**:233 (April) 1933.

18. Fenton, R. A., and Larsell, O.: The Histopathology and Clinical Interpretation of Experimental Sinus Disease, Tr. Am. Acad. Ophth., 1933, p. 329.

accumulation of plasma cells and fibrosis. Irradiated oil is useless in the treatment of sinusitis because of the clogging of ciliary action.

Hilding [19] cites the results of his experiments on dogs following partial and complete removal of the lining mucous membrane from the frontal sinuses. The entire mucous membrane was removed from 10 frontal sinuses of 8 dogs. Large portions of mucous membrane were removed from 4 sinuses of 4 dogs. The operative technic and the results are given in detail.

The author concludes that after removal of the lining membrane from the normal frontal sinus of dogs, the sinus usually fills with scar tissue, but in exceptional cases partial restitution of the sinus with regeneration of epithelium takes place. In some cases the cavity remains with thick connective tissue lining it. Epithelium may or may not line the cavity.

If portions of epithelium are left in the sinus, cysts form in the scar tissue.

Hilding carried out a series of experiments on dogs with normal sinuses. Following the removal of strips of mucous membrane on concave surfaces within the frontal sinuses, ridges and diaphragms formed. These interfered seriously with drainage. The removal of a small circular strip of mucous membrane usually results in two separate chambers in the sinus, but this can be avoided by having the cut edges closely approximated without leaving any bare bone.

An ostium can frequently be closed by taking a circular piece of mucous membrane from around it and leaving bare bone exposed.

It has been believed for many years that extract of suprarenal cortex detoxifies metabolic products and bacterial toxins, and also protects the body against bacterial invasion. In view of this belief, Wenner [20] experimented on rabbits by producing a maxillary sinusitis, and subsequently injected extract of suprarenal cortex in an effort to test the theory. Maxillary sinusitis was produced in 52 rabbits by irrigation of the sinuses with sodium alizarine sulphonate. The irrigation resulted in cessation of ciliary movement. Infection followed. After the nasal discharge appeared, the author divided the rabbits into two groups. One group was given injections of extract of suprarenal cortex and the other was used for control experiments. All the animals were killed, and their mucosa was examined. Microscopic examination of the

19. Hilding, A.: Experimental Surgery of the Nose and Sinuses: Gross Results Following Removal of the Intersinous Septum and of Strips of Mucous Membrane from the Frontal Sinus of the Dog, Arch. Otolaryng. **17**:321 (March) 1933.

20. Wenner, W. F.: Effect of Extract of the Suprarenal Cortex on Maxillary Sinusitis in the Rabbit, Arch. Otolaryng. **17**:774 (June) 1933.

treated rabbits revealed no evidence of infection except in 1 case. The sinuses of the control rabbits were seen macroscopically to contain varying amounts of pus. These animals showed varying microscopic pathologic changes.

Hunt [21] deplores the fact that rhinologists as a group know so little about the true pathologic changes in the mucosa of diseased sinuses. He feels that once the mucosa is definitely pathologic, nothing short of radical exposure and radical removal of all the diseased mucous membrane will suffice. Thoroughness in removing every vestige of the pathologic process is stressed in the author's operative technic. In reading the article, one feels that the author leans a little too far to the radical side.

Mittermaier [22] studied the mineral content of the dried residue of mucous membrane of the sinuses and also of the secretions from the sinuses in acute and chronic inflammations of the nose and the accessory nasal sinuses. The highest increase in mineral content is found in the secretion in acute rhinitis. In chronic inflammation of the maxillary sinus the mineral content remains rather constantly at a high level. An increase in mineral content can be due to accumulation of the secretion in the sinus over a long period. The change of a purulent secretion into a mucoid one is accompanied by an increase in mineral content. It was found that an edematous mucosa contains more minerals than a coarse flat mucosa with inflammatory changes. The increase in fluid content of secretions and mucosa which occurs parallel with the increase in mineral content indicates a tendency to equalize differences in osmotic pressure.

Israel and Nicholas [10] examined pus from the sinuses chemically, using the calcium and phosphorus contents as an index, in an effort to diagnose and prognosticate sinus disease. This plan had previously been used by Friesner and Rosen to determine the proper time for surgical intervention in cases of mastoiditis. The average amounts of calcium and phosphorus in pus obtained from nonosseous abscesses were used as a control. The authors found that the calcium content in frank sinus disease varied widely. In the majority of cases the patients with the most severe involvement and the most chronicity showed a high or noteworthy increase in the calcium content of the pus. They did not venture an opinion in their article as to the diagnostic value of their work, but from their previous article it is assumed that it is of little value.

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21. Hunt, J. G.: Treatment of Chronic Sinusitis, Canad. M. A. J. **28**:54 (Jan.) 1933.

22. Mittermaier, R.: Mineral Metabolism in Inflammatory Diseases of the Sinuses, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **134**:147, 1933.

Yamamoto [23] experimented on cats by plugging the nasofrontal duct with paraffin on cotton and then inoculating the frontal sinus with hemolytic streptococci, and also with volatile oil of mustard (U. S. P.) and tincture of iodine. Localized leptomeningitis developed, but when normal drainage was restored the leptomeningitis healed rapidly. This is the first time that experimental purulent meningitis has been produced by the sinus route. Apparently closure of the nasofrontal duct is the necessary factor. In cases of severe meningitis, the author found several distinct pathways of infection to the meninges.

Wagner [24] classifies nonspecific sinus disease into acute and chronic inflammations. The chronic inflammations are further divided into: (1) hypertrophic (infiltrative, hyperplastic and metaplastic), (2) degenerative (polypoid, cystic and atrophic) and (3) mixed (hypertrophic and degenerative). Careful microscopic descriptions amplified by many photomicrographs illustrate each classification. There is also a description of the normal mucous membrane in the article.

Jenssen [25] reports on a bacteriologic and a histologic study of the nasal sinuses of 40 heads. A little more than half of the sinuses which were histologically normal were sterile. The frontal sinus was most frequently sterile. The flora was relatively uniform in comparison with the typical nasal flora. The conditions of examination could be considered as physiologic, since postmortem invasion of the nasal sinuses does not start until relatively late. The chronic serous inflammations of the nasal sinuses develop on the basis of a chronic edematous condition of the mucosa characterized by functional deficiency. The recurrences are produced by an increase in the virulence of the saprophytic inhabitants of the sinus and a decrease in the resistance of the mucosa occurring in so-called "colds," and not through new infection with pathogenic organisms from the nose. A certain uniformity in the bacteriology of acute infection of the nasal sinuses and the tonsils appears indicated by the predominance of hemolytic streptococci.

Maclay [26] studied chronic maxillary sinuses from a bacteriologic standpoint in an effort to determine what organisms were present, and to compare them with the bacteria found in the nose. With a special technic described in detail in the paper, the author obtained cultures

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23. Yamamoto, Satoru: Experimental Studies on Rhinogenic Meningitis Originating in the Frontal Sinus, Jap. J. M. Sc. Tr., XII, Oto-Rhino-Laryng. **2**:15 (June) 1933.

24. Wagner, W. A.: Histopathology of Non-Specific Sinusitis, Texas State J. Med. **29**:329 (Sept.) 1933.

25. Jenssen, W.: Beiträge zur Bakteriologie und Histologie der Nasennebenhöhlen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **32**:439, 1933.

26. Maclay, O. H.: Bacteriology of the Maxillary Sinuses: Clinical Aspect, Ann. Otol., Rhin. & Laryng. **42**:567 (June) 1933.

from within the sinus. Forty-four cases (60 antrums) were studied. In 21 cases (30 antrums) a careful comparison of the nasal and antral organisms was made. The following organisms were found within the antrums: staphylococci, 37 times; streptococci, 26; pneumococci, 2; Haemophilus influenzae, 3; Micrococcus catarrhalis, 1; Proteus vulgaris, 1, and Proteus asiaticus, 3. The combinations were many and varied and did not agree with the nasal culture in many cases. The macroscopic appearance of the return fluid was no indication of the presence, kind or virulence of the organisms found.

Of the 60 antrums, 5 (8.3 per cent) were sterile, 19 (31.6 per cent) showed pure cultures, and the remaining 36 (60 per cent) showed a mixed culture. Organisms found in pure culture were Staphylococcus aureus in 8 antrums, Staphylococcus albus in 2, Streptococcus haemolyticus in 2, Streptococcus viridans in 4, pneumococci in 1, and Alcaligenes bronchisepticus in 2.

Getty [27] collaborated in the laboratory aspect of this study.

Turner and Loew [28] reduced the number of suppurative lesions of the upper respiratory tract in animals deprived of vitamin A by substituting carotene therapy. The incidence of bacteria in the nasal cavities and the middle ear is decreased in animals fed carotene as compared with those having no source of vitamin A. Carotene protects rats which are deprived of vitamin A from bacterial invasion of the upper respiratory tract.

Lindsay and Walsh [29] emphasize the value of cytologic examination of nasal smears. One hundred routine examinations were made. They found few cells in normal nasal secretion. They feel that the presence of eosinophils in nasal secretions is indicative of vasomotor rhinitis, though in 14.9 per cent of their cases they found a high percentage of eosinophils without a demonstrable allergy. When vasomotor rhinitis is complicated by infection, the ratio of eosinophils to polymorphonuclear leukocytes is lowered. In cases of infection without allergy, the nasal eosinophil count is never higher than 1 per cent. The authors conclude that a routine examination of nasal secretions affords a simple and effective laboratory aid in the diagnosis of vasomotor rhinitis when the clinical signs are masked by infection.

An unusual case of mucormycosis of the maxillary sinus is reported by Stevenson.[30] The fungus was discovered in pus washed from both

27. Getty, R. E.: Bacteriology of the Maxillary Sinuses: Laboratory Aspect, Ann. Otol., Rhin. & Laryng. **42**:576 (June) 1933.

28. Turner, R. G., and Loew, E. R.: Infection of the Sinuses in Vitamin A Deficiency: Rôle of Carotene in Infection of the Upper Respiratory Tract, J. Infect. Dis. **52**:102 (Jan.-Feb.) 1933.

29. Lindsay, J. R., and Walsh, T. E.: Nasal Secretions: The Value of Cytologic Examination to the Rhinologist, Arch. Otolaryng. **17**:783 (June) 1933.

30. Stevenson, H. N.: Mucormycosis of the Maxillary Sinus, Arch. Otolaryng. **18**:775 (Dec.) 1933.

maxillary sinuses of a patient during a routine examination. The forms of the organism first encountered resembled body cells so closely that their significance was passed over until forms encountered later made their identity certain. This organism was encountered over a period of seven months, during which time it underwent certain morphologic changes. It was exposed to antiseptic solutions which were instilled into the sinuses in an effort to eradicate the infection. The nasal mucous membrane showed chronic inflammatory changes. Chronic mastitis caused by the same organism was also present. On account of the patient's poor general condition, a Caldwell-Luc operation was not done. Under frequent antral irrigations a marked clinical improvement was noted, but the disease had not been eradicated. A detailed description of the organism is contained in the article.

Adams [31] reports a case of pansinusitis due to Aspergillus fumigatus. This etiologic factor in sinusitis is rare. The author could find only 8 cases reported previously in the literature. His case existed for six years unrecognized. Clinically, the symptoms were those of chronic suppurative sinusitis with toxic manifestations. Careful biologic and pathologic studies made the diagnosis possible. Thorough surgical removal followed by the internal administration of large quantities of potassium iodide brought about a cure.

Wherry,[32] Sugaya [33] and Gritti [34] also contributed papers on the pathology of the nasal sinuses.

BENIGN TUMORS

Fetissof [35] reports in detail the operative procedure in a case of osteoma of the ethmoid sinus which extended into the frontal sinus and encroached on the orbit. He states that 50 per cent of osteomas generally occur in the frontal sinus, 26 per cent in the ethmoid sinus, 6 per cent in the antrum and 3 per cent in the sphenoid sinus. The pedicle usually originates at the junction of the frontal and the ethmoid bone. He stresses the importance of total removal of the pedicle and its exact localization roentgenographically before removal. A wide external incision was used.

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31. Adams, N. F., Jr.: Infection Involving Ethmoid, Maxillary and Sphenoid Sinuses and the Orbit Due to Aspergillus Fumigatus: Report of Case, Arch. Surg. **26**:999 (June) 1933.

32. Wherry, W. P.: Paranasal Sinus: Pathology and Focal Infections, Colorado Med. **30**:439 (Nov.) 1933.

33. Sugaya, S.: Bacteriologic Study of Empyema of the Antrum, Taiwan igakkai Zasshi (Abstr. Sect.) **32**:17 (March) 1933.

34. Gritti, P.: Alterations in the Nasal Mucosa Due to Sinusitis: Experimental Study, Valsalva **9**:501 (July) 1933.

35. Fetissof, A. G.: Technical Procedure of Operation on Osteomas of the Ethmoid Labyrinth, Ann. Otol., Rhin. & Laryng. **42**:533 (June) 1933.

A severe case of nasociliary neuralgia caused by a pea-sized osteoma in the anterior ethmoid sinus is reported by Fenton.[36] The osteoma in this case was thought to have been caused by an old injury. At operation, it was found totally occluding the nasofrontal duct in the extreme lower part of the frontal sinus and probably impinging against the nasociliary nerve (anterior ethmoid). A detailed description of the ramifications of the nerve is contained in the article. The case presented a complex diagnostic problem. Frightful headaches, psychic changes, astigmatism, a suggestive sella turcica and dizziness complicated the picture.

Knapp[37] reports a case of osteoma of the frontal sinus in a girl, aged 15. The clinical signs were a visible flat protuberance above the root of the nose, a small palpable protuberance on the inner canthus and next to it, on the orbital margin, a small pulsating tumor. At operation it was seen that the osteoma had broken through the anterior wall of the frontal sinus. The pulsating tumor was a mucocele. The osteoma had also perforated the central and inferior parts of the posterior wall of the sinus and had become adherent to the dura. In an attempt to isolate the tumor at this point, the dura was ruptured. The operation was terminated without removal of the tumor. Meningitis did not result.

Colson[38] reports a case of osteoma of the frontal sinus which caused symptoms of headache and dizziness. The radical frontal operation was used to enucleate the mass which was found attached to the posterior wall of the sinus, and at its removal normal dura was exposed.

Gerrie[39] reports a case of fibroma of the maxilla removed by the Caldwell-Luc operation. The growth was of long standing and was diagnosed as a dentigerous cyst. An interesting feature of the case was an associated facial asymmetry due to underdevelopment of the masseter and anterior temporal muscles. The author's explanation is that it resulted from pressure on the third division of the trigeminal nerve.

MALIGNANT TUMORS

Öhngren[40] presents a valuable and exhaustive treatise on malignant tumors of the maxillo-ethmoidal region with special reference to treat-

36. Fenton, R. A.: Nasociliary Neuralgia Caused by Osteoma, Ann. Otol., Rhin. & Laryng. **42**:911 (Sept.) 1933.

37. Knapp, E.: A Case of Osteoma of the Frontal Sinus, Monatschr. f. Ohrenh. **67**:903 (Aug.) 1933.

38. Colson, Z. W.: Frontal Osteoma: Moulding Misplaced Frontal Septum: Case Report, Laryngoscope **43**:677 (Aug.) 1933.

39. Gerrie, J. W.: Fibroma of the Maxilla Resembling a Dentigerous Cyst and Involving the Maxillary Antrum, Canad. M. A. J. **29**:643 (Dec.) 1933.

40. Öhngren, L. G.: Malignant Tumors of the Maxillo-Ethmoidal Region: Clinical Study, with Special Reference to Treatment with Electrosurgery and Irradiation, Acta oto-laryng., 1933, supp. 19, p. 1.

ment by a combination of electrosurgery and irradiation. One hundred and eighty-seven cases were studied from 1924 to 1931, in 149 of which operation was performed. The author feels that electrosurgery with or without radiography (radium and roentgen rays) as used in Sweden produces better permanent results than other methods. He classifies tumors in the sinuses according to topography by a "malignancy line" drawn from the inner canthus of the eye to the angle of the jaw on each side—a help in diagnosing the origin of the tumor. Tumors arising above this line are considered most malignant on account of their encroachment on the brain.

Local and general clinical signs, symptoms and differential diagnosis are enumerated in great detail. The author stresses particularly that lacrimation is an early sign of new growth in the ethmoid region owing to irritation of the ethmoid nerves. Histologic studies of each type of new growth are minutely set forth. A description of the drainage of the lymph channels and explanations of metastases to the glands have a prominent place in the paper.

Öhngren uses Holmgren's technic in treatment by electrosurgery. External incisions are used sparingly except in extensive cases. Great dependence is placed on coagulation between electrodes prior to removal of the cancerous mass.

An incision used by the author splits the upper lip into the vestibule of the nose. All further incisions are made under the lip in the buccal mucous membrane. The soft parts are retracted extensively, and in this manner Öhngren claims to be able to remove completely extensive growths. A second incision at times used by the author begins at the inner canthus of the eye and extends horizontally to the midline.

His use of radium and the roentgen ray is gone into at length. A chapter is devoted to plastic reconstruction of the parts destroyed.

The author's results reveal symptom-free patients without demonstrable metastases in 38.5 per cent of the cases. The paper is worthy of careful perusal.

New [41] reports a case of squamous cell epithelioma grade II of the antrum which extended into the cheek and mouth; external operation, diathermy and radium therapy were employed. The patient is well ten years after operation. The author regards the use of diathermy and irradiation as a marked advance in the treatment of new growth of the sinuses.

Landau [42] stresses the importance of roentgen examination of the lacrimal passages with an opaque substance in all cases that show the

41. New, G. B.: Squamous-Cell Epithelioma of the Antrum, Without Recurrence After 10 Years, S. Clin. North America **13**:867 (Aug. 2) 1933.

42. Landau, J.: The Importance of Early Diagnosis of Malignant Neoplasms in the Region of the Lacrimal Sac, Ztschr. f. Augenh. **81**:168 (Aug.) 1933.

least suggestion of a malignant condition. He cites the case of a 67 year old patient who presented himself with a history of marked coryza two months previously, followed immediately by epiphora on the right side. Two weeks later the patient noticed a small induration in the right inner canthus. A roentgenogram showed obstruction of the right lacrimal sac at the level of the floor of the orbit. The obstruction appeared to be a bony mass. Operation was advised, but refused, until seven months later when a tumor of walnut size was removed. It was found to occupy the entire labyrinth of the ethmoid on that side and the mesial portion of the orbit. Examination after surgical removal revealed epidermoid carcinoma.

Cade [43] has had considerable experience in treating sarcoma of the antrum by high voltage roentgen therapy without surgical intervention. Four cases were reported with 2 recoveries, high voltage roentgen therapy alone being used in all. For the treatment of carcinoma of the antrum, a surgical exposure is needed to insert huge doses of radium. The author effects this by excising the hard palate. A case is reported to illustrate the procedure.

Houser [44] discusses the diagnosis and treatment of primary malignant neoplasms of the maxillary sinus. Twenty-one cases are reported of which 19 were cases of carcinoma and 2 of sarcoma, all originating within the antrum. Early diagnosis is difficult but imperative for successful treatment. Roentgen examination is the most reliable help for early diagnosis. In cases of unexplained pain over the antrum, the author advocates an early exploratory Caldwell-Luc operation for diagnosis. If a neoplasm is found, radium is inserted and roentgen therapy instituted. Radical removal of the upper jaw was performed in only 3 cases, in all of which the patients had a recurrence and died within a year. In 10 cases the Caldwell-Luc operation was performed and radium inserted. The condition in 6 cases was found to be inoperable, but roentgen and radium treatment were used. Of the 21 patients treated, 4 are alive (26.6 per cent of the 150 with operable conditions.) Two of these (13.3 per cent of those operated on) have passed the five year period. The author feels that surgical procedures are chiefly useful in exposing the lesion for direct irradiation.

Hautant, Monod and Klotz [45] report 21 cases of epithelioma of the ethmoid sinus in which the condition was treated by a combination

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43. Cade, S.: Radiation Treatment of Cancer of the Mouth and Pharynx (Hunterian Lecture), Lancet **2**:4 (July 1) 1933.

44. Houser, K. M.: Diagnosis and Treatment of Primary Malignant Neoplasms of the Maxillary Sinus, Arch. Otolaryng. **18**:643 (Nov.) 1933.

45. Hautant, A.; Monod, O., and Klotz, A.: Combination of Surgical and Radium Therapy in Ethmoido-Orbital Epitheliomas: Late Results, Ann. d'otolaryng., 1933, p. 385.

of surgical intervention and radium. They found that the usual site of origin of the tumors is the posterior ethmoid sinus from which the growth penetrates into the orbit. The antrum is invaded at a later date. Unilateral nasal obstruction with mucopurulent discharge often discolored with blood is an early symptom. The termination of the disease is nearly always fatal by the spread of the growth to the cribriform plate, the destruction of which leads to meningitis. Headache is an important symptom. The diagnosis is based on the roentgen and clinical findings. The authors prefer the extirpation of the cancerous area by approaching it through a curved incision starting over the glabella and extending around the lower margin of the orbit. The technic of the operation is described with illustrations. Details of the subsequent irradiation of the diseased area are given. Radon seeds are preferred to radium. The article concludes with a careful analysis of the cases in which treatment was instituted in the manner described.

Rossert [46] cites a case in which epithelioma of the antrum was discovered during examination, the diagnosis of neuralgia of the trigeminal nerve having been made.

Other articles on malignancy of the nasal sinuses are contributed by Mesolella [47] and Palumbo.[48]

FRONTAL SINUS

Chamberlain and Parry [49] report 6 cases of mucocele as a cause of proptosis. The authors point out that the displacement of the eye is the result of pressure caused by erosion of the orbital wall. The growth of a mucocele is very slow. Signs, symptoms, diagnosis and differential diagnosis are given. External frontal operation is the treatment of choice. Removal of the tumor together with all the mucosa of the sinus is indicated. The authors insist that a large permanent opening from the frontal sinus into the nose for drainage is imperative.

Zöllner [50] cites 2 cases of chronic frontal sinusitis which resulted in pyoceles of the frontal sinuses after the nasofrontal duct had become occluded by inflammatory swelling and granulation tissue. The sinuses

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46. Rossert: Epithelioma of the Antrum Discovered During Diagnosis of Trigeminal Neuralgia: Report of a Case, Rev. d'oto-neuro-opht. **11**:114 (Feb.) 1933.

47. Mesolella, V.: Cancer of the Nasal Sinuses on the Right Side, Boll. d. mal. d. orecchio, d. gola, d. naso **51**:349 (Aug.) 1933.

48. Palumbo, V.: Technic of Radium Treatment of Tumors of the Sinuses, Radiol. med. **20**:303 (March) 1933.

49. Chamberlain, W. B., and Parry, T. L.: Mucocele as a Cause of Proptosis: Report of Six Cases, Arch. Otolaryng. **18**:172 (Aug.) 1933.

50. Zöllner, F.: Occlusion of the Nasofrontal Duct and Development of Pyocele, Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres **31**:47, 1933.

showed definite dilatation without rupture. In another case complete closure of the nasofrontal duct by scar tissue resulted. One case of unilateral mucocele of the frontal sinus showed the nasofrontal duct closed by an osteophyte-like tumor. In a case of mucocele of the ethmoid sinus combined with pyoceles of both frontal sinuses, the closure of the ducts was probably due to trauma.

A case of pyocele of the frontal sinus is reported by Thoeny.[51] Following coryza, an abscess formed over the forehead. The patient refused operation, but finally was prevailed on to allow a small incision to be made over the abscess followed by intranasal operation. The end-result was a clinical cure with no nasal discharge whatever, but with a small dry permanent fistula at the site of the original incision. The anterior frontal wall was found by roentgen examination to have been absorbed.

The preparation, premedication and operative technic of the radical operation on the frontal sinus under local anesthesia are discussed by Collier.[52] Nothing particularly new is brought out in the paper.

A short discussion of some of the problems incident to the Knapp-Bárány-Lynch fronto-ethmoidal operation is contributed by Bass.[53] The author is very enthusiastic relative to the merits of this operation as borne out by his results. As to after-care, he quotes Lynch's dictum of "leave them alone." A detailed description of each step in the operation is contained in the paper.

Tonndorf [54] advised simple trephining of the frontal sinus in cases of severe acute frontal sinusitis that do not clear up under conservative treatment. Trephining causes much less trauma in the infected area than intranasal operations. He admits that the procedure is old, but urges that it should not be neglected. A small piece of bone is removed from the region where the anterior and inferior walls meet, and a rubber drain is inserted. The mucous membrane should be traumatized as little as possible, and special care should be taken that the rubber drain does not come in contact with the posterior wall of the sinus. Daily irrigations with saline solution thereafter are advised. During a recent epidemic, Tonndorf treated 6 patients in this manner. Four showed conditions ranging from edema of the lid to subperiosteal abscess; 1 showed all the signs and symptoms of rather severe sepsis, which disappeared quickly. All the cases cleared up rapidly.

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51. Thoeny, O. W.: Mucocele and Pyocele of the Frontal Sinus, Southwestern Med. **17**:60 (Feb.) 1933.

52. Collier, G. B.: Radical Frontal Sinus Operation Under Local Anesthesia, South. M. J. **26**:941 (Nov.) 1933.

53. Bass, A. L.: My Observation of Lynch Ethmo-Frontal Operation, Kentucky M. J. **31**:385 (Aug.) 1933.

54. Tonndorf: Surgical Therapy of Acute Suppurations of the Frontal Sinus, Ztschr. f. Hals-, Nasen- u. Ohrenh. **34**:428, 1933.

Yates [55] discusses the problem of fractures of the skull involving the frontal sinus. This discussion is based on 10 personal cases, in 8 of which there was recovery following operation. The cases of fracture are grouped into three subheads: simple, simple depressed and compound comminuted. The third type is always operative. In the other two types, operation depends on whether or not the posterior wall of the frontal sinus is fractured. Rhinorrhea is a complication which usually demands operation. No set rule can be laid down for these cases, the surgeon's experience counting for most.

Reports of 2 cases of chronic frontal sinusitis in which radical operation (Howarth) was performed are contributed by Whale.[56] Both patients made a satisfactory recovery.

Other contributors to the subject of the frontal sinus are Rosengren,[57] Rebattu and Proby,[58] dall'Olio [59] and Gioacchini.[60]

ETHMOID SINUS

Reports of 14 cases of paranasal sinusitis in which external ethmosphenoidectomy was performed are contributed by Griffith and Warren.[61] The authors deplore the poor results obtained in many intranasal operations and attribute this to incomplete removal of all pathologic mucous membrane of the sinus. The authors have a series of about 100 cases in which operation was performed by the external route, with gratifying results in most instances. They feel that the scar is unobservable after a few months, and that the operation is less dangerous and much more thorough than that performed by the internal route. The symptomatology and diagnosis and a detailed description of the operation are given. The authors stress particularly that every bit of diseased mucous membrane should be removed. One wonders whether this can actually be done even when combined with the Caldwell-Luc operation, and if done whether it is absolutely indicated.

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55. Yates, E. C.: Management of Skull Fractures Involving the Frontal Sinus, Kentucky M. J. **31**:362 (Aug.) 1933.

56. Whale, H. L.: Two Unusual Cases of Frontal Sinusitis, J. Laryng. & Otol. **48**:608 (Sept.) 1933.

57. Rosengren, B.: Development of Double Images After External Radical Operations on the Frontal Sinus, Acta ophth. **11**:161, 1933.

58. Rebattu, J., and Proby, H.: Acute Frontal Sinusitis with Subcutaneous Suborbital Abscess Followed by Cerebral Abscess: Report of a Case, Lyon méd. **151**:9 (July 2) 1933.

59. dall'Olio, C.: Bilateral Fronto-Ethmoidal Mucocele: Report of a Case, Oto-rino-laryng. ital. **3**:427 (July) 1933.

60. Gioacchini, R.: Fronto-Ethmoidal Mucocele, Valsalva **9**:523 (July) 1933.

61. Griffith, G. E., and Warren, E. D.: Observations on Sinus Surgery, with Special Reference to External Ethmosphenoidectomy, Northwest Med. **32**:236 (June) 1933.

Dunn [62] accepts Skillern's classification of ethmoiditis into four groups: acute catarrhal, acute suppurative, chronic catarrhal (hyperplastic) and chronic suppurative. The signs, symptoms, complications and treatment of ethmoiditis are discussed under these headings.

Haiman [63] reports 2 cases of fistulas following external operation on the ethmoid sinus. After vain attempts to close the fistulas, the author finally instilled ultraviolet irradiated oil. The fistulas immediately responded favorably, which the author attributes to the virtue of the oil.

Kerley [64] presents a case of acute ethmoiditis with exophthalmos, and stresses the necessity of early diagnosis and treatment.

Hirsch [65] contributes a paper on diseases of the ethmoid and sphenoid sinuses.

MAXILLARY ANTRUM

Pordes [66] cites a case of acute purulent antral sinusitis in which death occurred six days after puncture of the antrum for irrigation. The needle was inserted in the posterior third of the inferior meatus and entered the pterygopalatine fossa, causing abscess. Extensive drainage promptly done on discovery of the complication was of no avail. The infection had extended cranially and into the mediastinum.

In a discussion of the treatment of subacute maxillary sinusitis, Blassingame [67] strongly advises irrigation of the antrum through the natural opening in the middle meatus. He has had no difficulty in finding the natural opening. He deplores the fact that it has not been adopted as an easy procedure for the office.

Treer [68] studied the volume and the rate of drainage of the maxillary sinus by means of injections of iodized poppy-seed oil 40 per cent. In persons between the ages of 25 and 60, the volume of the maxillary sinus under normal conditions varies between 5 and 12 cc. Under pathologic conditions, the volume of the maxillary sinus in 58 per cent of the patients was only from 0 to 4 cc.; sinuses of this size were not

62. Dunn, L. S.: Ethmoiditis: Various Forms and Their Treatment, Laryngoscope **43**:848 (Oct.) 1933.

63. Haiman, J. A.: Ultra-Violet Irradiated Oil (Petrolatum) in Fistulae Following External Ethmoid Operation, Eye, Ear, Nose & Throat Monthly **12**:241 (July) 1933.

64. Kerley, C. G.: Acute Ethmoiditis: Case with Exophthalmos, Arch. Pediat. **50**:136 (Feb.) 1933.

65. Hirsch, C.: Diseases of Ethmoid and Sphenoid Sinuses, Rassegna internaz. di clin. e terap. **14**:274 (March 31) 1933.

66. Pordes, M.: Complication Following Puncture of the Antrum, Monatschr. f. Ohrenh. **67**:692 (Jan.) 1933.

67. Blassingame, C. D.: Treatment of Subacute Maxillary Sinusitis, J. Tennessee M. A. **67**:439 (June) 1933.

68. Treer, J.: Volume of the Antrum from Physiologic and Pathologic Points of View, Monatschr. f. Ohrenh. **67**:681 (June) 1933.

found under normal conditions. Sinuses with a volume of from 5 to 7 cc. were found in 20 per cent of the normal subjects and in 27 per cent of the persons with pathologic conditions. Sinuses with a volume of from 8 to 12 cc. were found in 80 per cent of the normal subjects but in only 15 per cent of those with pathologic conditions. This shows that the measurement of the unobstructed volume of the maxillary sinus is a measure of the extent of the pathologic process existing in the sinus and is therefore of practical value. Complete drainage of the injected iodized oil from the normal sinus was effected in one week in 16.1 per cent of the subjects, in two weeks in 61.3 per cent and in several weeks in 22.6 per cent.

Treer [69] compared the following methods of examination of the maxillary sinus: irrigation, roentgenoscopy with and without a contrast medium, determination of the volume and rhinoscopy. He concludes that negative rhinoscopic results are more reliable than the results obtained with the other methods. Only positive rhinoscopic results necessitate further examination. The extent of the pathologic process in the sinus can be best determined by measuring the volume (free space) of the sinus. If the volume is from 0 to 4 cc., surgical opening of the cavity is always indicated; if it is from 8 to 12 cc., further surgical intervention without special indications is superfluous. If the volume varies between 5 and 7 cc., then the positive or negative rhinoscopic results must determine conduct.

A symposium on maxillary sinusitis, which includes pathology, symptomatology, diagnosis and treatment, is contributed by Eggston,[70] Fairbairn,[71] Jones [72] and Sulzman.[73] The classification of the pathologic changes is based on the vascular changes in the mucous membrane and includes three varieties: (1) hypertrophic or polypoid, (2) atrophic or fibrotic sclerotic characterized by an increase in the fibrous connective tissue in the stroma with thinning of the mucous membrane and (3) a combination of the two. This type is characterized by rugae or sulci. A detailed description of each type is given accompanied by many photomicrographs. Fairbairn discusses the symptomatology, Jones the diagnosis and Sulzman the treatment of maxillary sinusitis.

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69. Treer, J.: Comparative Clinical Examinations of the Antrum, Monatschr. f. Ohrenh. **67**:841 (July) 1933; Orvosi hetil. **77**:734 (Aug. 19) 1933.

70. Eggston, A. A.: Maxillary Sinusitis—Pathology, New York State J. Med. **33**:508 (April 15) 1933.

71. Fairbairn, J. F.: Maxillary Sinusitis—Symptomology, New York State J. Med. **33**:515 (April 15) 1933.

72. Jones, M. F.: Diagnosis of Maxillary Sinusitis, New York State J. Med. **33**:517 (April 15) 1933.

73. Sulzman, F. M.: Maxillary Sinusitis—Treatment, New York State J. Med. **33**:519 (April 15) 1933.

A case is reported by Wright and Gerrie [74] in which a pin was removed from the maxillary antrum by the Caldwell-Luc operation. The authors feel that the foreign body was probably lost in the antrum during a difficult extraction of a tooth years previously.

A case in which multiple foreign bodies were removed by means of the Caldwell-Luc operation from the maxillary sinus is reported by Horgan.[75] While feeding a piece of timber to a revolving saw, the patient was struck in the cheek by some object and rendered unconscious. One month later, the author removed two pieces of wood which completely filled the antrum. The pieces of wood had started to germinate and had thrown out many tendrils.

Wachsberger [76] describes in detail the endonasal radical operation on the antrum (the Canfield-Sturman operation). He feels that this procedure permits visibility of and accessibility to every part of the mucous membrane and allows surgical intervention in all its parts. Advantages claimed for this operation over the Caldwell-Luc technic are the elimination of an oral incision, no secondary plastic procedures, short operative time, shorter period of convalescence and less operative shock.

Davis [77] presents 2 cases of lacrimal obstruction following intranasal operation on the antrum. In each case the opening into the antrum had been made above and below the attachment of the inferior turbinate bone. The lower end of the lacrimal canal had been injured. Both patients were successfully treated by West's operation.

Wasowski [78] states that suppuration of the maxillary sinus constitutes 6.3 per cent of the rhinologic conditions of all the diseases of the sinuses. Suppuration of the maxillary sinus usually occurs unilaterally. Inflammatory processes in the nose of infectious or traumatic origin and disease of the teeth play the chief rôle in the development of this disease; it is favored by deviation of the septum. The author enumerates the signs, symptoms and operative procedures for disease of the maxillary sinus.

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74. Wright, R. P., and Gerrie, J. W.: Pin in the Maxillary Antrum, Canad. M. A. J. **33**:65 (Jan.) 1933.

75. Horgan, J. B.: Multiple Foreign Bodies in the Maxillary Antrum, J. Laryng. & Otol. **48**:52 (Jan.) 1933.

76. Wachsberger, A.: Endonasal Radical Operation on the Antrum, Arch. Otolaryng. **17**:222 (Feb.) 1933.

77. Davis, E. D. D.: Two Cases of Lacrimal Obstruction Following Operation on the Maxillary Sinus (Skiagrams Shown), Proc. Roy. Soc. Med. **26**:241 (Jan.) 1933.

78. Wasowski, T.: Chronic Suppurative Inflammation of the Maxillary Sinus: Clinical Study and Frequency of Occurrence at Wilno, Monatschr. f. Ohrenh. **67**: 153 (Feb.) 1933.

Magee [79] discourses in a general way on the management of infections of the maxillary sinus. Some of the usual methods of diagnosis are touched on. Acute infections of the maxillary sinus and their connection with the common cold, sinusitis in children and therapy have a prominent place in the article. The paper does not make any original contribution.

Suppuration of the maxillary antrum is outlined by Davis.[80] The anatomy, signs, symptoms and treatment are touched on in the paper—merely a short résumé of what has always been known about maxillary sinusitis.

Robinsohn [81] states that the first roentgenographic signs of an odontogenic disease of the mucosa of the maxillary sinus are to be found in the intra-oral roentgenograms of the maxillary sinus. Over the root apexes of the teeth which approach or reach the floor of the maxillary sinus, or which lie against the anterior or the posterior wall of the sinus, there can be seen a ridge-shaped thickening of the soft parts which protrudes toward the air space of the sinus. The shadow admits the need for amplification and possibly correction of his concepts, but he believes that he has pointed the way to a study of manifestations in the perifocal region of the teeth near the maxillary sinus.

Blumenthal [82] describes his technic for closure of a bucco-antral fistula resulting from dental surgical procedures. A circular flap is laid over the fistula with the epithelial surface toward the antrum, the raw surface being covered by a secondary flap cut from the adjacent buccal mucosa. This results in complete closure.

Blumenthal [83] reports a case of suppuration of the maxillary sinus caused by the presence of two teeth in the sinus. The teeth were not supernumerary, but were the last two teeth of the left supramaxilla which had developed within the sinus and were missing from the dental arch. At the point of the alveolar process at which the missing teeth should have developed, there was a fistula into the antrum. Pus was discharging through this fistula—not through the nose, as is usually the case in suppuration of the maxillary sinus. The location of the two teeth in the posterior wall of the sinus relatively far from the dental

79. Magee, F. E.: Management of Maxillary Sinus Infections, Pennsylvania M. J. **37**:102 (Nov.) 1933.

80. Davis, E. D. D.: Suppuration of the Maxillary Antrum, Lancet **2**:885 (Oct. 14) 1933.

81. Robinsohn, I.: Unusual Roentgenographic Dental Symptom of Initial Inflammation of the Antrum: Initial and Terminal Odontogenic Changes of the Antral Wall and Regional Mucosa, Monatschr. f. Ohrenh. **67**:145 (Feb.) 1933.

82. Blumenthal, A.: Closure of a Bucco-Antral Fistula, Ztschr. f. Laryng., Rhin., Otol. **24**:58, 1933.

83. Blumenthal, A.: Suppuration Due to Displaced Development of Teeth in the Antrum, Ztschr. f. Laryng., Rhin., Otol. **24**:62, 1933.

arch is not remarkable when one considers that the development of the teeth takes place in a very early period of life during which the lumen of the sinus is small and the individual walls are close together.

De Blasi [84] reports a large paradental cyst of the right maxillary sinus. Mayoux [85] reports a case of bleeding polyp of the maxillary sinus causing epistaxis.

SPHENOID SINUS

Proetz [86] contributes a paper on the microscopic examination of the sphenoid ostium. The bony part of the ostium comes to a sharp edge around which no structure except epithelium can be seen to pass from nose to sinus or from sinus to nose. The tunica propria of the sinus can scarcely be said to enter into the formation of the ostium, as it terminates abruptly short of the margin and is very thin. The nasal mucosa, on the other hand, is many times thicker and is permeated with vascular channels and glandular elements and can be said to enter more properly into the formation of the ostium. The author feels that though the mucous membranes of the nasal and sphenoid sinuses, respectively, may swell, only extreme tension can cause the tissues to encroach on the ostium in such a way as to close it, that in inflammation the nasal side of the ostium swells much more than the sinus side, and that the application of astringents such as ephedrine to the neighborhood of the ostium should suffice to open it.

Vail [87] notes some practical considerations in infection of the sphenoid sinus and discusses Sluder's neuralgia of Meckel's ganglion. He believes that this neuralgia is due not to irritation of Meckel's ganglion, as Sluder maintained, but to a true inflammation of the vidian nerve in the floor of the sphenoid sinus. He has seen 34 such cases. Relief was obtained in all the cases by treatment of the sphenoid sinus. The two factors in the production of neuralgia of the vidian nerve are (1) infection of the sphenoid sinus and (2) pneumatization of the sphenoid sinus so that there is close relationship between the vidian nerve and the mucosa of the sphenoid. A treatise on the methods of diagnosing disease of the sphenoid sinus follows. The author divides his treatment into medical and surgical methods. The medical treatment consists of astringent sprays, nasal douches, infra-red light therapy and treatment

84. de Blasi, A.: Large Paradental Cyst of the Right Maxillary Sinus, Otorino-laring. ital. **3**:227, 1933.

85. Mayoux, R.: A Bleeding Polyp of the Maxillary Sinus Causing Epistaxis: Report of a Case, Lyon méd. **151**:674 (May 28) 1933.

86. Proetz, A. W.: Minute Anatomy of the Sphenoid Ostium, Tr. Am. Laryng. A. **55**:125, 1933.

87. Vail, H. H.: Practical Consideration of Sphenoidal Sinus Infection, Ohio State M. J. **29**:432 (July) 1933.

with Dowling's tampon. Rarely is the external approach to the sphenoid sinus necessary. The mucosa should not be removed unless it is grossly diseased.

Garber [88] does not agree with Sluder or Vail in the explanation of Sluder's syndrome. He does not believe that fibers of the sympathetic or of the vidian nerve can act as a conductor of pain impulses, but feels that it is the maxillary nerve which is involved in the production of pain. The author gives in detail his explanation of the mechanism through which he believes referred pain and neuralgia of the face go by way of the maxillary nerve instead of the vidian or sympathetic nerve fibers.

Sewall [89] feels that cytologic study of the contents of the sphenoid sinus is of definite value in rational sinus therapy. A sphenoid cannula can with great regularity be placed in the sphenoid ostium with a little care, patience and practice. The cannula is fixed in position by an ingenious cannula holder attached to a tongue depressor held firmly between the teeth. A syringe is used to withdraw the contents of the sinus. At times it is necessary to inject sterile warm water, which is immediately withdrawn and examined for bacteria and cells. The author examined 110 sinuses. He was unable to enter 12 of these. Of the 98 sphenoid sinuses entered, 8 were clear, 2 contained pus, and flakes were found in 188. On examination, mononuclear leukocytes were found in 57 cases, mononuclears and polymorphonuclears in 7 and polymorphonuclears in 4 cases. These results seem to furnish evidence of inflammation of an acute character in a small number of the cases examined, while many more showed an essentially chronic process.

PARANASAL SINUSES IN GENERAL

Sanders [90] studied a large group of patients complaining of vague symptoms in the chest and found that in practically all cases of chronic nontuberculous pulmonary diseases there is a concomitant source of infection in the sinuses. The author firmly believes that these infections must be cleared up early and thoroughly to alleviate the thoracic symptoms.

Wantoch [91] reports 4 cases of tuberculosis of the accessory nasal sinuses. The disease was located in 1 case in the ethmoid bone, in another

88. Garber, H.: Sinusitis and Neuralgia, Arch. Otolaryng. **18**:339 (Sept.) 1933.

89. Sewall, E. C.: Cytologic Study of Diseases of the Sphenoid Sinus, Ann. Otol., Rhin. & Laryng. **42**:391 (June) 1933.

90. Sanders, S. H.: Sinuses in a Group of Patients Complaining of Vague Chest Symptoms, South. M. J. **26**:420 (May) 1933.

91. Wantoch, H.: Tuberculosis of the Sinuses, Schweiz. med. Wchnschr. **53**: 73 (Jan. 21) 1933.

in the ethmoid bone and the antrum of Highmore, in a third in both antrums of Highmore and in a fourth in the sphenoid sinus. The author states that primary tuberculosis of the accessory nasal sinuses is rare. Most cases come from carious teeth and diseased tonsils. Secondary tuberculosis usually is transmitted by way of the blood and rarely through the nasal or oral mucous membrane. In tuberculosis of the accessory nasal sinuses, the treatment of the sinuses gives only a temporary relief, never permanent. The disease is always chronic. Sometimes spontaneous hemorrhages occur, in which case a mistaken diagnosis of a malignant growth is made. Edema of the overlying skin and lateral cervical glands sometimes is present. Recovery may be possible if all the diseased mucous membrane is entirely removed surgically.

An article on increased intracranial pressure with a normal spinal fluid associated with disease in the pneumatic spaces of the head is contributed by Carmack.[92] The author is cognizant of the fact that this condition usually obtains as a complication of mastoid infection, but he cites a case of infection of the sphenoid and ethmoid sinuses that was cured by operation. The symptoms encountered are headache, drowsiness, papilledema and loss of vision if the process is allowed to continue unchecked. Meningeal symptoms are rare. The cause and the underlying pathologic process remain obscure but are probably excessive secretion from the choroid plexus, or defective absorption through the arachnoid villi due to a localized meningeal irritation or serous meningitis. Treatment should be directed toward elimination of the primary focus plus repeated spinal punctures.

Fishbein [93] describes his treatment of the nasal sinuses by diathermy associated with nasal tampons soaked in mild silver protein after the method of Dowling. The purpose of the diathermy is intended merely to increase the efficacy of the tampons and to decrease the time of treatment. The author states that acute and chronic infections are benefited by this treatment. The diathermy apparatus consists of an indifferent electrode in the shape of a head band strapped around the forehead, and a positive electrode tape of fine metal completely covered with cotton and immersed in the solution of silver protein. The positive electrode is inserted in the nose.

An interesting article on the reflex neuralgias of the face is presented by Vail [94] under seven headings dealing with neuralgia of the

92. Carmack, J. W.: Relation of Increased Intracranial Pressure to Disease in Pneumatic Spaces, Ann. Otol., Rhin. & Laryng. **42**:364 (June) 1933.

93. Fishbein, J. N.: The Use of Diathermy Treatment of the Nasal Accessory Sinuses, Arch. Otolaryng. **18**:198 (Aug.) 1933.

94. Vail, H. H.: Syndrome of Pain in Its Reference to the Eye, Ear, Nose and Throat, Tr. Am. Acad. Ophth., 1933, p. 255.

gasserian, sphenopalatine, vidian and geniculate ganglions, neuralgia of the tympanic plexus, glossopharyngeal neuralgia and neuralgia of the great superficial petrosal nerve. The author has had several cases in which chronic suppurative maxillary sinusitis has simulated neuralgia of the gasserian ganglion and cure was obtained by adequate operations on the sinus. He feels that neuralgia of the sphenopalatine ganglion is a rare condition and that most neuralgias around the face are caused by irritation of the vidian nerve induced by a pathologic process in the sphenoid sinus. The remaining types of neuralgia discussed have to do with pain in or around the ear.

Nemour produced a marked eosinophilia in the mucosa of the antrum by introducing pilocarpine into a vein, thus stimulating the parasympathetic system. The author found a 55 per cent nasal eosinophilia in a patient following the ingestion of digitalis by mouth. This was unaccompanied by any change in the nasal mucosa suggestive of allergy. Therefore, eosinophilia, in his opinion, is not diagnostic of an allergic condition. Wenner's work on rabbits in which he cured suppurative disease of the sinus with injections of extract of suprarenal cortex is quoted. Dean [95] feels that the action of inorganic salts in the causation of rhinologic pathologic processes could be studied with profit. Stress is laid on the great importance of studying all rhinologic problems from the standpoint of internal medicine.

Wirth [96] feels that the virulence of pneumococci during the course of acute sinusitis remains constant as a rule during the disease. Marked variations are rare and have no bearing on the clinical course. Cure of the disease and development of complications are independent of virulence phenomena of the pneumococci.

Eigler and Geisler [97] report severe injuries to the nervous system in 5 cases following injections of acriflavine hydrochloride into the spinal canal for treatment of purulent rhinogenous meningitis. All 5 patients died; 2 of them showed severe changes in the spinal cord which had resulted in complete transverse paralysis. Experimental injections into 2 normal monkeys showed similar changes. The authors advise frequent and complete emptying of the spinal canal and intravenous injections of methenamine and acriflavine hydrochloride. However, it would seem that therapy with acriflavine hydrochloride is extremely dangerous and should be used with caution.

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95. Dean, L. W.: A Discussion of Certain Fundamental Things Influencing the Infection of the Nasal Sinuses, Ears and Lungs, Tr. Am. Acad. Ophth., 1933, p. 225.

96. Wirth, E.: Virulence of Pneumococci in the Course of Acute Sinusitis, Beitr. z. Anat., Physiol., Path u. Therap. d. Ohres **31**:8, 1933.

97. Eigler, G., and Geisler, W.: Severe Injuries from Endolumbar Injections of Trypaflavine (Acridine Dye) in Therapy of Suppurative Rhinogenous and Otogenous Meningitis, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **134**:201, 1933.

Wodak [98] discusses the relation of pain due to pus in the sinuses and the neuralgic pain caused by the sinusitis. Ordinarily, the pain in the sinuses lasts only as long as pus is present. The secondary neuralgia of the trigeminal nerve generally clears up with the process in the sinus, but has a tendency to last a little longer. The great epidemic of influenza of 1933 caused many cases of sinusitis, which were marked by severe neuralgia, the latter persisting long after the infection had cleared up. Often there were extensions into other nerve regions—the occipital, branchial and vertex regions. From his observations, the author believes that the influenza virus has a special affinity for nerve tissue, especially that of the fifth nerve.

The problems of headache and pain in inflammation of the nasal sinuses are discussed by Tilley.[99] When pain happens to be a symptom of chronic inflammation of the nasal sinuses, its cause is frequently the retention of pathologic secretion under tension. Pain or headache may be complained of, however, even when drainage is free. Referred pains are common. It is Tilley's experience that pain is more likely to be of the localized or of the referred variety when only one sinus is affected, whereas a general headache is more common when more than one air cell is inflamed. A discussion of referred pains from the separate sinuses follows. The author also believes in the theory of frontal vacuum headaches. Pain from involvement of the sphenoid sinus, vidian nerve and Meckel's ganglion is touched on. In his summary and conclusions, Tilley emphasizes the importance of correct diagnosis in these conditions, especially when operative intervention is indicated.

The management and operative technic of chronic sinusitis are reviewed by Smith.[100] The author advocates thorough external exenteration of the sinuses under local anesthesia, with thorough removal of all diseased mucous membrane after the method of Sewall. The author has performed over 500 operations by this method with only 5 deaths. One cannot help but feel that he seeks to overstandardize the operative procedure in chronic sinusitis. Simple procedures certainly avail in selected cases without reliance on radical surgical measures.

Jenkins [101] is inclined to feel that purulent sinuses do act as a focus of infection but probably not with the frequency one would be led to

98. Wodak, E.: Nasal Accessory Sinus Disease Followed by Trigeminal Neuralgia, Characteristic of Recent Influenza Epidemic, Med. Klin. **29**:676 (May 12) 1933.

99. Tilley, H.: Headache and Pain in Inflammation of the Sinuses, Brit. M. J. **1**:549 (April 1) 1933.

100. Smith, F.: Chronic Sinus Disease: Its Present Status, J. A. M. A. **100**: 402 (Feb. 11) 1933.

101. Jenkins, W. H.: Sinuses as Foci of Infection, M. Ann. District of Columbia **2**:179 (Aug.) 1933.

suppose in view of the comparatively large number of purulent sinuses observed. The author thinks, however, that infected sinuses occupy a position of less importance in infection than such foci as diseased teeth, diseased tonsils and disordered intestines. He further believes that absorption takes place more readily from the mucosa of the sinus when there are infected cysts or areas of ulceration. Jenkins is convinced that certain ocular and pulmonary diseases are due to infection of the sinuses.

Glasscheib [102] states that allergic catarrhal inflammation of the nose often originates in a purulent inflammation of the maxillary sinuses. Some of the pus secreted by the mucosa is resorbed, especially when there is stasis, and with it the toxins and products of protein decomposition from the disintegrated bacteria. These constitute antibodies. The union of antigen and antibody leads to the development of allergy within about eight days. The reaction of the secretion is alkaline instead of acid as in most allergic secretions. This theory of pathogenesis has a therapeutic interest. In the treatment of acute suppuration of the maxillary sinus, resorption of the pus should be prevented by aspiration or irrigation. If an allergic inflammation develops, desensitization with albumin should be instituted. The administration of acid may also be tried. If the polypi do not regress with this therapy, curettage may be tried, followed by desensitization. The inflammation usually extends to the ethmoid, frontal and sphenoid sinuses, but is most easily recognized in the maxillary sinuses. The disease passes imperceptibly from the acute to the chronic stage, and its early recognition is therefore all the more important.

A classification of acute and chronic inflammatory disorders of the posterior sinuses with a discussion on their etiology and treatment is given by Lemaitre, Aubin and others.[103] Numerous causes which contribute to chronicity are reviewed. They include swelling of the mucous membrane of the ethmoid sinuses, high deviation of the septum, chronic purulent infection of the adenoids and clumsy nasal douching in cases of ozena.

The authors point out that while the etiology of acute and chronic purulent sinusitis may be simple enough, the etiology of nonpurulent sinusitis, especially of polypoid sinusitis and hyperplastic sinusitis, is not simple, and different theories regarding the disease are reviewed. The writers believe that the general condition of the patient plays an

102. Glasscheib, A.: Pathogenesis and Therapy of Allergic Inflammation of the Nasal Accessory Sinuses, Monatschr. f. Ohrenh. **67**:565 (May) 1933.

103. Lemaitre, F.; Aubin, A., and others: Ætiology and Treatment of Acute and Chronic Inflammatory Disorders of the Posterior Sinuses, Proc. Roy. Soc. Med. **26**:969 (Sept.) 1933.

important part in the appearance and evolution of polypoid sinusitis. If an inflammatory or simple irritative process is prolonged, the mucous membrane, which at first reacts only superficially in the epithelial layer, begins to react in the deeper layer, especially in the periosteum. In the ethmoid sinus particularly the periosteum is inseparable from the nasal mucous membrane. The participation of periosteum in the inflammatory process explains the lesions in the bone, the partial absorption of the bony layers, which secondarily take on the appearance of "necrosing ethmoiditis." Polypoid sinusitis and hyperplastic sinusitis are histologically the same inflammatory process in different stages.

Endonasal operations accomplish the complete destruction of the ethmoid and sphenoid foci of infection and are satisfactory. The external operation does not give results much superior to the endonasal operation and should not be employed unless there is a complication threatening. The medical treatment of sinusitis is also given. The paper is discussed by Yates, Tilley, Watson-Williams, Whittington Graves and Peckworth.

Frazee [104] does not favor the Proetz displacement method of making roentgenograms of the sinuses. He feels that a roentgenogram made by this method has no advantages over a good roentgenogram taken in the usual manner. However, he does like the displacement method in the treatment of conditions of the sinuses. He tried this treatment on 68 patients, 63 per cent of whom showed improvement. Five-tenths per cent ephedrine in physiologic solution of sodium chloride was used in the treatment. Headache was the most common chief complaint, and the author was able to bring about relief in the majority of these cases. In his series of patients with atrophic rhinitis, the author was able to make them feel much more comfortable.

Parkinson [105] calls attention to a modification of the Proetz displacement method of treating sinuses which he calls the lateral head-low position. In this position the head, instead of being placed directly backward, is held low in a lateral position. The advantage claimed is that medication can more easily and completely fill the sinuses.

Coates [106] speaks on some of the general indications for radical surgical procedures on the sinuses. These are divided into absolute and relative indications. The relative indications are signs and symptoms that may not be sufficiently severe at first to warrant subjecting the patient to a radical operation but which may become absolute at

104. Frazee, J. R.: Disease of the Sinuses: Diagnosis and Treatment by Displacement, Arch. Otolaryng. **17**:554 (April) 1933.

105. Parkinson, S. N.: A Lateral Head-Low Position for Nasal and Sinus Treatment, Arch. Otolaryng. **17**:787 (June) 1933.

106. Coates, G. M.: General Indications for Radical Sinus Surgery, Ann. Otol., Rhin. & Laryng. **42**:400 (June) 1933.

any time. Furthermore, what may be an unimportant symptom to a person in one walk of life may constitute in another adequate reason for advanced surgical work. Thus, indications for radical surgical intervention follow operative judgment and cannot be said to be definite.

Treer [107] studied 307 cases of nasal polypus and found that in the great majority the maxillary sinus was practically normal. This confirmed Zuckerkandl's assertion that nasal polypi result from frequent inflammation of the nasal mucosa on the basis of predisposition. However, the inflammation of the nasal mucosa often extends into the sinuses and often produces hypertrophic inflammation of the accessory sinuses owing to impeded drainage from the sinuses by nasal polypi. The development and cure of chronic and acute purulent and hypertrophic inflammatory processes of all the accessory sinuses are governed by the drainage in the individual cases.

Harris [108] comments on the difficulty of distinguishing the causes of headaches which are amenable to physical intervention and those which are not. The radiation of pain far beyond the territory of the actual nerve trunk affected makes diagnosis difficult. Harris emphasizes that in high strung neurotic persons referred pain spreads more widely and readily. It is important to remember that referred pain does not spread across the midline.

Facial psychalgia is fairly common and is frequently mistaken for and treated as tic douloureux. True neuralgia of the trigeminal nerve may have its origin from an infected antrum.

Uffenorde [109] reports the case of a man with a typical picture of septicemia for which no explanation could be found. A roentgenogram showed a zone of increased density in the right maxillary sinus with great swelling of the mucosa. On puncture, a mucopurulent secretion was obtained. At radical operation on the right maxillary, ethmoid and sphenoid sinuses, the diseased mucosa from the maxillary sinus was removed and another cavity was found behind it, separated from the first one to a great extent by a bony septum. This cavity and the ethmoid sinus were cleaned out; the sphenoid sinus was found to be clear. The frontal sinus was opened and probed. The second day after operation the temperature dropped rapidly and complete recovery soon followed. The rapid disappearance of the septicemic symptoms definitely indicates, according to the author, that the septicemia originated in the infected sinus. He thinks that radical intervention with

107. Treer, J.: Relation Between Nasal Polypi and Hypertrophic Inflammation of the Accessory Sinuses, Monatschr. f. Ohrenh. **67**:1065 (Sept.) 1933.

108. Harris, W.: Headache and Pain in Inflammation of the Sinuses, Brit. M. J. **1**:551 (April 1) 1933.

109. Uffenorde, W.: Sepsis from Acute Suppuration of the Nasal Accessory Sinuses, Ztschr. f. Hals-, Nasen- u. Ohrenh. **33**:1, 1933.

exposure of the entire infectious focus is the only adequate procedure in cases of this kind. In this case, the rare second chamber of the maxillary sinus would have been overlooked if this had not been done.

In connection with the report of 5 cases, Csillag [110] gives a comprehensive discussion of injuries of the nasal sinuses, including their complications, symptoms, diagnosis and therapy. If the force causing the trauma is slight, only edema or a hematoma may appear in the skin, although a fracture of the corresponding wall of the sinus may exist. Inflammation and suppuration of the mucosa of the sinus usually follow fracture of the wall. Occasionally the extravasated blood is resorbed, and no inflammatory complication occurs. Meningitis and abscess of the brain are the most dangerous complications. A constant symptom of injury to the sinuses is hemorrhage from the nose or mouth. Ocular symptoms often dominate the clinical picture. Roentgenographic and ophthalmologic examination should always accompany rhinologic examination. Isolated injury of the frontal sinus is not infrequent. The sphenoid sinus is most rarely involved. The nature and degree of the lesions are best judged by surgical exposure, as the roentgenogram does not always show this clearly. The infectious cerebral complications are best avoided by exposure of the seat of the injury, removal of fractured segments of bone and creation of a wide communication with the nasal cavity.

Eadie [111] studied the relation of nasal sinusitis to general infection. His conclusions were drawn from postmortem examination in 120 cases, and the clinical study of over 100 cases. Postmortem examination revealed the presence of nasal sinusitis in 11 fatal cases of lobar pneumonia, and in 16 of 22 cases of bronchopneumonia. Sinusitis was less frequent in pulmonary tuberculosis.

Peroni [112] discusses the effects of suppuration of the sinus on the larynx and lungs. He recalls that there can be chronic infection of the sinuses without suppuration but with hyperplasia of the mucosa. Secretions from the sinuses gravitate into the lungs and are responsible for the development of some diseases of the upper air passage. Peroni feels that hypertrophic laryngitis often results, especially in the posterior half of the larynx, with thickening in the interarytenoid region. Contact ulcers on the vocal process of the arytenoids sometimes result, with occasionally loss of cartilage. He feels that there is an intimate connection between infection of the sinuses and bronchiectasis. The sinusitis

110. Csillag, A. L.: Injuries of the Accessory Nasal Sinuses, Ztschr. f. Laryng., Rhin., Otol. **24**:64 (March) 1933.

111. Eadie, C. M.: Nasal Sinusitis in Relation to General Infection, M. J. Australia **1**:637 (May 27) 1933.

112. Peroni, A.: Relation Between Chronic Inflammation of the Sinuses and Chronic Laryngitis, Arch. ital. di otol. **44**:257 (May) 1933.

is often primary. The author does not believe that the presence of an infection of the sinuses or of nasal polypi is sufficient to cause asthma, but is of the opinion that the nasal region and the asthma are different manifestations of the same allergic state. He agrees, however, that such lesions in the nose aggravate the asthma and must be cleared by surgical or other measures before the asthma is likely to improve.

MacCowan [113] points out that the importance of toxemia as a causative factor in the psychoses is still undetermined. He feels that tonsillitis and nasal infections are considered to be the most important causative factors in some forms of mental disease. His deductions are based on 807 persons admitted consecutively to the Cardiff City Mental Hospital. Sinusitis in this series was responsible for 47 per cent of the cases of psychosis. This is much lower than the results obtained at Birmingham, England, with which results the author's findings are compared.

MacCowan considers that infections of the nasal sinuses and tonsils are important causative factors in a small minority of cases of psychosis. They are especially important in the toxic exhaustive processes in which they appear to be comparatively common and frequently causative.

Matis [114] gives a detailed description of his intranasal operation for radical surgical intervention on the sinuses. It consists of an intranasal approach to the various sinuses through an incision in the lateral nasal wall immediately posterior to the vestibule, giving free exposure of the canine fossa and the ascending processes of the maxilla. The author is able, by his technic, to remove the floor of the frontal sinus and expose the ethmoid cells and even the sphenoid sinus. Fourteen clear figures and illustrations indicate graphically the details of the operative procedure he suggests. No reports of cases are given. One feels rather doubtful that so much intranasal surgical work can be done well through such a small approach.

Hurd [115] claims that occasionally a pathologic process in a sinus is the cause of asthma. Thorough operation on the sinus in such cases associated with proper vaccines made from the patient's organisms sometimes results in brilliant recovery from the asthma. Three cases are reported in detail to substantiate this claim.

Eadie [116] examined at autopsy the accessory nasal sinuses of 6 patients who died of active tuberculosis of the lungs. Four had normal

113. MacCowan, P. K.: Infection of the Nasal Sinuses and Tonsils in the Psychoses, Lancet **2**:853 (Oct. 14) 1933.

114. Matis, E.: Surgery in Pansinusitis, Ztschr. f. Hals-, Nasen- u. Ohrenh. **33**:527, 1933.

115. Hurd, L. M.: Nasal Accessory Sinuses as Foci of Infection in Chronic Arthritis, Ann. Otol., Rhin. & Laryng. **42**:39 (March) 1933.

116. Eadie, C. M.: Sinusitis in Relation to Pulmonary Tuberculosis, M. J. Australia **1**:345 (March 8) 1933.

sinuses; 2 had acute infections of some of the sinuses, probably a terminal infection. The findings indicate to the author that the association of sinusitis and phthisis is not a frequent occurrence. In fact, he feels that phthisis does not often develop in people with chronic nasal disease and, conversely, those with phthisis do not often have chronic sinusitis.

Connell [117] discusses some of the general aspects of sinusitis. He reviews their classification from the anatomic, pathologic and etiologic points of view. Symptomatology and treatment are also touched on. The author particularly stresses prevention of chronicity. He feels that sinusitis can serve as a focus of infection for arthritis, bronchosinusitis, colitis and various ocular conditions.

Cohen [118] reports a case of adenoma of the pituitary gland which caused symptoms simulating sinus disease. The author admonishes one to remember that not all headaches are caused by this disease.

The controversial question as to whether sinus disease can act as a focus of infection is discussed by Wherry. The arguments both for and against the proposition are enumerated, but no definite answer is ventured by the author. Wherry feels that more clinical research is needed before an answer is forthcoming.

Chronic infection of the paranasal sinuses with special reference to disease of the lower respiratory tract are discussed by Kern and Schenck.[119] Abnormalities such as a high deviation of the septum plus bacterial invasion are the prime causes of chronic sinusitis. They state that three fourths of the population have or have had at some time a protracted or a severe infection of the sinuses. Chronic disease of the lower respiratory tract attended by purulent sputum in large amounts (such as bronchiectasis) shows an overwhelming incidence of chronic disease of the sinuses. Which is the primary disease, the authors will not answer categorically. However, they do stress the fact that the infection must be cleared up before the disease of the respiratory tract can be cured. They also feel that disease of the sinuses develops secondarily to allergy. The authors claim originality in the observation that the finding of nasal polyps should always suggest further study from the standpoint of allergy. They arrive at this conclusion by their failure to find polyps in the great majority of patients with nonallergic diseases.

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117. Connell, E. S.: Diseases of the Nasal Accessory Sinuses, J. Missouri M. A. **30**:1 (Jan.) 1933.

118. Cohen, H. B.: Report of a Case of Adenoma of Pituitary, Producing Headache of the Type Caused by Sinus Disease, Laryngoscope **43**:496 (June) 1933.

119. Kern, R. A., and Schenck, H. P.: Chronic Paranasal Sinus Infection: Relation to Diseases of the Lower Respiratory Tract, Arch. Otolaryng. **18**:425 (Oct.) 1933.

Eighty cases of chronic hyperplastic sinusitis were studied clinically, bacteriologically and pathologically by Grove and Cooke [120] in an effort to establish the causation of this condition. They feel that infection is the true cause of hyperplasia and occurs in a person with an allergic constitution. The hyperplasia thus represents a sensitization to the infection.

Cox [121] describes the treatment of chronic infections of the nasal sinuses by the use of autogenous vaccines. A description of each of the 21 patients treated is given. Fifteen of the patients were so improved as to be classed as cured. Three were not helped. Three were helped subjectively without altering the underlying pathologic process. The author describes the preparation of the vaccines.

Carroll [122] feels that most cases of acute and chronic sinusitis can be cured without the use of extensive surgical intervention. He describes his method of shrinking the nasal mucous membrane with packs followed by extensive irrigation of the nasal passages with warm physiologic solution of sodium chloride. It is for the latter that he claims especial virtue in his treatments.

Gaudet [123] discusses some of the problems relative to acute sinusitis. An analysis of 62 cases is given in his paper. The author favors conservatism in treatment—rest in bed, astringent nasal sprays to encourage ventilation and drainage and general supportive treatment. Ephedrine, in the author's opinion, is a much overrated drug.

Bullen [124] studied 400 cases of chronic sinusitis with special reference to the incidence of asthma. Asthma was present in only 12.25 per cent of the cases, indicating that chronic sinusitis per se is not a frequent cause of asthma. The author agrees with the prevalent idea that the condition which tends to produce asthma also is the etiologic factor for sinusitis. He concludes that chronic bronchitis and bronchiectasis are rather infrequently dependent solely on chronic disease of the paranasal sinuses for their causation.

Several hundred patients with asthma were examined by Weille.[125] Of this group, 40 were selected for operation on the sinuses. According

120. Grove, R. C., and Cooke, R. A.: Etiology and Nature of Chronic Hyperplastic Sinusitis, Arch. Otolaryng. **18**:622 (Nov.) 1933.

121. Cox, W. C.: Autogenous Vaccines in the Treatment of Chronic Sinus Infections and Nasal Allergy, Mil. Surgeon **73**:121 (Sept.) 1933.

122. Carroll, F.: Acute and Chronic Sinus Disease: More About That Bane of Rhinologist's Existence, Colorado Med. **30**:228 (June) 1933.

123. Gaudet, L. S.: Acute Sinusitis, New Orleans M. & S. J. **86**:383 (Dec.) 1933.

124. Bullen, S. S.: Incidence of Asthma in 400 Cases of Chronic Sinusitis, J. Allergy **4**:402 (July) 1933.

125. Weille, F. L.: Studies in Asthma: Surgical Treatment of Chronic Sinusitis in Asthma, J. A. M. A. **100**:241 (Jan. 28) 1933.

to observations in the group studied, 75 per cent of the patients having asthma associated with sinusitis show a favorable local result in the nose following nasal surgical procedures, but have only about a 50 per cent chance for relatively long-continued favorable changes in their asthma.

The most favorable cases of asthma for improvement by surgical measures are those in which there are polypi in the nose and sinuses; patients having thickened membrane or cysts in the sinuses are unfavorable subjects for such operations.

Indications for operation on the sinuses in asthmatic patients include: (*a*) sinus disease demanding surgical treatment on its own merits, (*b*) recurrent colds in the head precipitating asthmatic attacks (the aim of surgical intervention is to lessen the number of such colds), (*c*) severe cases of asthma in which interruption of the vicious downward cycle yields temporary relief and (*d*) cases in which removal of polypi or irrigation of the sinus yields temporary benefit.

Weldon [126] believes that disease of the sinuses is not an etiologic factor in allergic asthma. Exceptions to this belief are observed in rare cases in which the patient is sensitive to bacterial protein. Allergic asthma and disease of the sinuses often are concomitant, each dependent on the same etiologic factors. The latter is an etiologic factor in asthmatic bronchitis, or asthma due to an infection.

Warner and McGregor [127] removed the lining membrane from the antrums in 31 cases of bronchial asthma in an effort to determine the efficacy of the Caldwell-Luc operation in asthma. The patients were followed for two and one-half years. In only 2 cases were the results favorable and permanent. In all cases there was a period of freedom from asthma following the operation, but relapse occurred later. The longest period was twenty-seven months, the shortest two weeks and the average four months. These results are so poor that the authors advise extreme caution in advocating operations on the sinuses for asthma. They are unable preoperatively to prognosticate which patients would be benefited permanently by the procedure. One patient was operated on as a life-saving measure.

Baum [128] feels that systemic disorders such as allergy, endocrine imbalance or diets deficient in vitamin A are responsible for many cases of sinusitis. A secondary infection usually follows, which may necessitate surgical intervention, but the author does not believe that a cure

126. Weldon, W. A.: Relation of Sinus Disease to Asthma, Kentucky M. J. **31**:360 (Aug.) 1933.

127. Warner, W. P., and McGregor, G.: Effect of Radical Antral Surgery on Bronchitic Asthma, J. Laryng. & Otol. **48**:595 (Sept.) 1933.

128. Baum, W. W.: Nasal and Accessory Sinus Disease as Manifestations of Systemic Disorders, Northwest Med. **32**:245 (June) 1933.

can be effected by surgical measures alone. It is only by combining rhinologic treatment with the elimination of the systemic disorder, which was the primary etiologic factor, that satisfactory results may be obtained.

Hollender [129] leans toward conservative rhinologic treatment in disease of the sinuses. Only after minor operative procedures have failed does he advise radical measures. He relies much on physical aids in his treatments, such as diathermy, zinc ionization and infra-red therapy. Prolonged infra-red irradiation, he feels, is especially beneficial, owing probably to a chemical reaction in the irradiated tissues.

Piquet [130] and Terracol, Galavielle, Guibert and Joyeux [131] also have contributed to the literature on the paranasal sinuses.

SINUS DISEASE IN CHILDREN

Hoople and Cave [132] studied two groups of cases of scarlet fever to determine the incidence of associated sinusitis and infections of the middle ear. Information regarding the first group of 29 cases was obtained mainly by roentgenograms. In the second group of 80 cases an attempt was made to correlate clinical and roentgenologic findings. In both series, roentgen evidence of sinusitis was present in approximately 90 per cent of the cases—quite a high figure. It should be noted, however, that in the second group of 80 cases there was roentgen evidence of a pathologic process in 68, in 26 per cent of which the clinical signs were negative. In all the cases in which otitis media was observed, there was roentgen evidence of an associated sinusitis. The authors raise the question as to whether or not involvement of the sinuses should be considered the rule rather than a complication of scarlet fever.

Munyo and Iglesias Castellanos [133] feel that ethmoiditis may occur in children as early as the age of 1 year. The symptoms are irregular temperature, nasal discharge and frontal headache. A diagnosis is best made by roentgenograms. The child should have a balanced diet rich in vitamin A. Vaccine gives the best results. Twelve illustrative cases are described and are illustrated with roentgenograms.

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129. Hollender, A. R.: Conservative Treatment of Nasal Sinusitis; Evaluation of Physical Aids and Newer Concept of Infrared Radiation, M. J. & Rec. **137**:147 (Feb. 15) 1933.

130. Piquet, J.: Surgical Therapy of Chronic Suppurative Sinusitis, Echo méd. du nord **37**:265 (June 10) 1933.

131. Terracol; Galavielle, Guibert and Joyeux: Nasopharyngeal Polyp of Sinusal Origin in a Girl 12 Years Old, Arch. Soc. d. sc. méd. et biol. de Montpellier **14**:141 (March) 1933.

132. Hoople, G. D., and Cave, L. S.: Otorhinologic Aspects of Scarlet Fever, with Particular Reference to the Sinuses, J. A. M. A. **101**:1121 (Oct. 7) 1933.

133. Munyo, J. C., and Iglesias Castellanos, A.: Medical Therapy of Ethmoiditis in Children: Report of Eleven Cases, Arch. urug. de med., cir. y especialid. **2**:390 (March) 1933.

Kerley and Lorenze [134] examined roentgenologically the nasal accessory sinuses of 430 children who presented such complaints as frequent colds, chronic cough and nasal discharge, asthma, rheumatism and a persistent slight elevation of temperature. Disease of the sinuses was demonstrated by the roentgenograms in 296 cases. It is interesting that 72.6 per cent of the children showing cloudiness of the sinus had previously had their tonsils and adenoids removed. Satisfactory results were observed following intranasal medication and general supportive measures.

Kerley [135] calls attention to the relative frequency of sinusitis in infants and in young children. The author believes that transillumination will in many instances indicate sinusitis, but negative findings by transillumination do not exclude the disease. Roentgen examination should be made in cases in which infection is suspected. The article contains illustrations which the author believes represent the normal sinuses at different ages of infancy and of childhood.

A general discussion of sinusitis in children is presented by Fischbach.[136] He stresses the frequency with which sinusitis is overlooked in early life and states that 65 per cent of cases in adults have their beginning in childhood. A plea for more careful and thorough examination for involvement of the sinuses in children is made. The subject is discussed under four headings: focal infection, allergy, diet and contact with chronic infection in the environment. Some practical methods in handling each group are enumerated.

Uhr and Pugh [137] report their studies of chronic sinusitis in children. Children complaining of frequent colds were examined carefully for signs of chronic sinusitis. The histories of 18 patients are presented. A definite connection was seen between chronic nasopharyngitis and chronic infection of the sinuses in children. Marked improvement followed treatment, which was planned to be as simple as possible, depending on the pathologic conditions. The authors are convinced of the value of the proper surgical treatment in children when pus is present.

Osincup [138] presents in a general way the anatomy, etiology, symptoms, diagnosis, complications, treatment and prevention of sinusitis in children. It is a review of what has been published before, and nothing new is added.

134. Kerley, C. G., and Lorenze, E. J., Jr.: X-Ray and Clinical Study of Accessory Sinuses in 430 Infants and Children, J. Pediat. **2**:175 (Feb.) 1933.

135. Kerley, C. G.: Radiographic Studies of Normal Sinuses in Infants and Children, Arch. Pediat. **50**:323 (May) 1933.

136. Fischbach, V. W.: Sinus Disease in Children, West Virginia M. J. **29**: 145 (April) 1933.

137. Uhr, J. S., and Pugh, J. W.: Chronic Sinusitis in Children: Its Relationship to Frequent Nasopharyngitis, J. Pediat. **2**:418 (April) 1933.

138. Osincup, G. S.: Sinus Infection in Children, South. M. J. **26**:521 (June) 1933.

Mettel [139] discusses chronic sinusitis in children from the standpoint of etiology. The subject is taken up under the headings of local findings, histopathologic examination, roentgenographic examination and treatment. Under treatment, special emphasis is given to desensitization, vaccines, diet and alkali and acid forming foods. Operation on the sinuses is also considered.

Kerley [140] finds that the vast majority of children who experience frequent colds also have sinusitis. Roentgenograms were made of 173 such patients, and 133 showed a pathologic process in the sinuses. The majority were between the fifth and ninth years. The sexes were about evenly divided. The antrum was the most frequently involved.

Banister [141] believes that a most effective treatment for sinusitis in children after tonsillectomy is postnasal spraying and douching. This tends to prevent chronicity. The author states that the treatment can easily be carried out in very young children once their confidence is gained by gentleness. His paper deals with the etiology, symptomatology, anatomy, diagnosis and treatment of sinusitis in children.

A general discussion of sinusitis in children is contributed by Cohen.[142] His paper includes the anatomy of the sinuses, etiology of sinusitis and signs, symptoms, prognosis and treatment of the disease. The author especially emphasizes thoroughness in diagnosis.

Other authors on the subject of sinusitis in children are Terracol, Galavielle and Cadilhac,[143] Brisotto,[144] Mayoux,[145] and Moro.[146]

ORBITAL COMPLICATIONS

Unterberger [147] gives a detailed record of 4 cases of latent, and 1 case of manifest, infection of the sphenoid and ethmoid sinuses, which had unsuspectedly and for various periods induced ocular or orbital com-

139. Mettel, H. B.: Diagnosis and Treatment of Allergic Conditions and Chronic Sinus Infections in Children, J. Indiana M. A. **26**:147 (April) 1933.

140. Kerley, C. G.: Relation of Frequent Colds in Children to Sinus Disease, J. M. Soc. New Jersey **30**:209 (March) 1933.

141. Banister, E. B.: Infection of Sinuses in Children, Journal-Lancet **53**:3 (Jan. 1) 1933.

142. Cohen, H. B.: Sinusitis in Children—Rhinological Viewpoint, Laryngoscope **43**:670 (Aug.) 1933.

143. Terracol; Galavielle, J., and Cadilhac: Maxillary Sinusitis in an Infant 3 Months Old, Arch. d. sc. méd. et biol. de Montpellier **14**:269 (Aug.) 1933.

144. Brisotto, P.: Traumatic Sinusitis in Children, Boll. d. mal. d. orecchio, d. gola, d. naso **51**:302 (July) 1933.

145. Mayoux, R.: Sinusitis of Frontal, Ethmoid and Maxillary Sinuses in a Child 4 Years Old, Lyon méd. **151**:109 (July 23) 1933.

146. Moro, L.: Ethmoid Sinusitis Due to Streptococcic Rhinitis in an Infant: Report of a Case, Prat. pediat. **11**:267 (Aug.) 1933; Lattante **4**:516 (Oct.) 1933.

147. Unterberger, S.: Lingering Orbital Complications in the Presence of Isolated Chronic Inflammations of the Accessory Sinuses, München. med. Wchnschr. **80**:1317 (Aug. 25) 1933.

plications. These cases include paralysis of one or more ocular muscles, exophthalmos (afebrile), papillitis, severe loss of vision and ptosis and were for the most part quickly relieved by exploration and surgical drainage of the sinus found to be at fault.

Hawkins [148] presents records of 2 cases of exophthalmos from disease of the nasal sinuses. He cites the signs, symptoms and mechanism by which the exophthalmos is produced. Early cavernous sinus thrombosis is also considered. A differential diagnosis between infection from the sinuses and benign or malignant tumors is presented in the paper. The author also describes the treatment of sinusitis complicated by exophthalmos. In cases of pure edema of the orbital contents the best method of treatment is intranasal. When actual pus is present, radical drainage is advised. The prognosis of the different degrees of infection producing an orbital pathologic process is given a prominent part in the article.

Hitz [149] presents reports of 6 cases illustrating different methods of dealing with orbital cellulitis secondary to infection of the sinuses. The ethmoid and frontal sinuses are usually at fault. The author comes to the conclusion that no standardized method of attack can be advocated on account of the variability in the virulence of infection, differences in anatomic structure, difference in the time of onset and complications present. External operation is advised when the characteristic signs of pus are present.

The histories of 5 cases with exophthalmos as a prominent sign are reported by Mengel.[150] The cases present problems in the diagnosis between sinusitis and a malignant condition. The history, findings and operative details are outlined. A general discussion of the differential diagnosis of exophthalmos follows.

Hoople [151] discusses the rhinologic findings in cases of retrobulbar neuritis. Once a diagnosis of retrobulbar neuritis is made, the author advises eradication of all definite foci of infection, whether they are in the sinuses or in any other part of the body. When no definite collection of pus can be found in the sinuses and the patient is growing progressively worse, he feels that the patient should help decide whether or not an operation is to be undertaken, since the status of operative intervention in such cases in which pus is not found is not definitely estab-

148. Hawkins, R. W.: Relation of Exophthalmos to Sinus Disease, New York State J. Med. **33**:65 (Jan. 15) 1933.

149. Hitz, J. B.: Management of Orbital Cellulitis Secondary to Sinus Infection, Wisconsin M. J. **32**:318 (May) 1933.

150. Mengel, W. G.: Exophthalmos: Its Relation to Neoplasm and Nasal Accessory Sinus Disease, J. M. Soc. New Jersey **30**:132 (Feb.) 1933.

151. Hoople, G. D.: Retrobulbar Neuritis: Rhinological Findings, New York State J. Med. **33**:365 (March 15) 1933.

lished. The author quotes Dr. L. E. White as stating that 85 per cent of the patients recover under conservative local treatment, and that the teeth and tonsils are responsible for more cases than the sphenoid and posterior ethmoid sinuses. The author on the whole favors operative intervention.

Blatt [152] thinks that disease of the sinuses as the etiologic factor in retrobulbar neuritis has been greatly overestimated. Statistics have shown that diseases of the central nervous system, especially multiple sclerosis, are far more important. The author has observed 44 cases during the last fifteen years. Patients who were operated on did no better than those who were not operated on. If occasionally relief is obtained following operations on the sinuses it should be remembered that spontaneous improvement has resulted in some cases of retrobulbar neuritis which were due to multiple sclerosis.

Bergmeister [153] records a case of acute retrobulbar neuritis in a girl, 19 years of age. The patient experienced failing vision, and a diagnosis of acute retrobulbar neuritis was made. She was treated conservatively for four days, during which time her vision gradually became worse. Rhinoscopy gave negative results, and a roentgenogram of the sinuses showed nothing definite. However, because the case was progressing adversely, an external operation on the frontal and ethmoid sinuses was performed. The lining mucosa was injected, but no pus was found. The vision improved moderately after this operation. However, four months later a definite diagnosis of incipient multiple sclerosis was made, which probably accounted for the ocular symptoms. Bergmeister, however, is of the opinion that even in this case there was justification for opening the nasal sinuses at the time of the operation. However, in view of the later findings, one can hardly agree with the author that operation was indicated, however justifiable it might have seemed at the time.

Souchet and Lacroix [154] report a case of retrobulbar neuritis in which all the signs, symptoms and roentgen evidence pointed to pansinusitis on the left side. A radical frontal operation revealed normal sinuses. After the operation, the neuritis entirely cleared up. Presumably it was an acute flare-up following coryza.

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152. Blatt, N.: Question of Diseases of the Nasal Sinuses as a Cause of Retrobulbar Neuritis, Wien. klin. Wchnschr. **83**:1037 (Sept. 9) 1933.

153. Bergmeister, R.: Acute Retrobulbar Neuritis of Rhinogenic Origin and Multiple Sclerosis, Wien. klin. Wchnschr. **46**:556 (May 5) 1933.

154. Souchet, J., and Lacroix, A.: Retrobulbar Neuritis and Diplopia with False Signs of Frontal Sinusitis: Recovery After Surgical Therapy, Rev. d'oto-neuro-opht. **11**:26 (Jan.) 1933.

Benedict [155] believes that when one considers the vast number of cases of severe suppurative disease of the sinuses without visual symptoms, the connection between sinusitis and retrobulbar neuritis becomes remote. At the Mayo Clinic the etiologic factor in the great majority of 225 cases of retrobulbar neuritis was found to be multiple sclerosis. In only 1 case was sinusitis thought to be the cause. In more than 500 definitely proved cases of multiple sclerosis which the author observed, the great majority of the patients complained of disturbance of vision. The treatment that the author has used with the best results is the intravenous injection of triple typhoid vaccine. In comparing the treatment by means of foreign protein with the effect of operation on the sinuses, the author feels that the improvement obtained is due to the same factor, namely, an increased peripheral circulation. The resultant improvement in the circulation of the nerve restores its function. It is Benedict's conviction that drainage of secretion from the paranasal sinuses is not the prime factor in the relief obtained by the operation, but that the hyperemia due to the packing and reaction of the operation, and inoculation by absorption of blood, are the factors which are responsible for the improvement.

Other authors who have written on the subject of orbital complications are Russo-Frattasi,[156] Lumbroso,[157] Meksina and Khayutin,[158] Sobol,[159] Rollet,[160] and Guedes de Mélo.[161]

OSTEOMYELITIS

Mosher and Judd [162] contribute a valuable paper on osteomyelitis of the frontal bone complicating frontal sinusitis. Seven patients were studied carefully, 4 of whom recovered and 3 died. A description of the microscopic histology of the bone together with many photomicro-

155. Benedict, W. L.: Retrobulbar Neuritis and Disease of the Accessory Sinuses, Arch. Ophth. **9**:893 (June) 1933.

156. Russo-Frattasi, G.: Pathogenesis and Clinical Aspects of Chronic Polysinusitis with Orbital Complications, Ann. di ottal. e clin. ocul. **61**:187 (March) 1933.

157. Lumbroso, U.: Acute Retrobulbar Neuritis Following Ethmoidosphenoidal Sinusitis Due to Koch-Weeks Bacillus, Valsalva **9**:512 (July) 1933.

158. Meksina, M., and Khayutin, I. M.: Ocular Complications in Latent Posterior Sinusitis, Sovet. vestnik oftal. **2**:275, 1933.

159. Sobol, I.: Perfection of Extra-Orbital Exenteration of the Orbit and Sinuses, Riv. oto-neuro-oftal. **10**:255 (May-June) 1933.

160. Rollet, J.: Paralysis of Common Oculomotor Nerve as a Complication of Sinusitis, J. de méd. de Lyon **14**:165 (March 20) 1933.

161. Guedes de Mélo Jr.: Rôle of Inflammation of the Maxillary Sinus in Etiopathogenesis of Trachoma: Report of 7 Cases, Arq. Inst. Penido Burnier **2**: 152 (March) 1933.

162. Mosher, H. P., and Judd, D. K.: Analysis of 7 Cases of Osteomyelitis of the Frontal Bone Complicating Frontal Sinusitis, Laryngoscope **43**:153 (March) 1933.

graphs is included in the paper. The pathways of infection, the gross and microscopic pathologic changes and the technic of operation for osteomyelitis are carefully detailed. The authors feel that edema of the skin and soft tissues of the forehead is the first sign of infection of the medulla of the bone and the periosteum, and is a practical guide to the extent of bone to be removed. At operation, two large triangular skin flaps give the best exposure. The authors advise that removal of the bone should begin beyond the limit of the edema, generally at or near the hair line, and be carried downward from normal to diseased bone. The roentgenogram does not show positive signs until necrosis occurs and therefore not until a week or ten days after the edema is present. One should not wait for positive roentgen findings but should operate at the first sign of edema. When the roentgenogram is finally positive, the osseous pathologic process has extended 1 or 2 inches (2.5 or 5 cm.) beyond the area indicated in the roentgenogram. Extensive radical removal of all necrotic bone together with some of the adjoining normal bone offers the best chance of recovery. The article is to be commended for careful study.

Hesse [163] discusses 7 cases of osteomyelitis of the sphenoid bone, all of which ended fatally. Histologic examination of the affected parts was carried out in several instances. The etiology was different to some extent in each case. In cases 1 and 2, the cause of a cavernous sinus thrombosis and meningitis was found to be osteomyelitis of the sphenoid bone secondary to an infection of one sphenoid sinus. In case 3, the clinical signs pointed to meningitis of an aural origin, but postmortem examination showed infection of the sphenoid sinus with osteomyelitis of the sphenoid bone and an intracranial extension from that region. In cases 4 and 5, osteomyelitis of the sphenoid bone was secondary to an infection of the petrous bone. In case 6, the cavernous sinus thrombosis was secondary to an infection of the middle ear. The sphenoid sinuses in this case were healthy. At autopsy in the last case the real cause of the cavernous sinus thrombosis was found to be a suppurating hematoma in the roof of the orbit around the bony fragments of a small fracture, the patient having knocked his head against a stair rod a few days before the onset of the illness. Osteomyelitis was found at the tip of the petrous in the right half of the sphenoid bone. In case 7, the etiology of the osteomyelitis of the sphenoid was in doubt. The cases form an interesting clinical group.

A report of a case of osteomyelitis of the frontal bone is given by Nodine.[164] The frontal sinuses were found to communicate with each

163. Hesse, W.: On the Etiology of Osteomyelitis of the Sphenoid Bone, Arch. Ohren-, Nasen- u. Kehlkopfh. **137**:94, 1933.

164. Nodine, E. R.: Sequestrum of the Frontal Sinuses, New York State J. Med. **33**:1141 (Oct. 1) 1933.

other and were filled with creamy pus. The interfrontal septum was found as a sequestrum in one of the sinuses during the radical operation. The patient made an uneventful recovery.

A report of a case of pansinusitis complicating diabetes mellitus is contributed by Kalteyer and Bernstein.[165] The patient had a severe case of diabetes, and stupor and coma rendered diagnosis and treatment most difficult. Unilateral paralysis of the third to the eighth cranial nerve complicated the picture. At autopsy, osteomyelitis of the roof of the ethmoid and sphenoid sinuses was found. This had involved the dura, causing a basal meningitis.

ROENTGENOLOGY

In a study of 383 cases of scarlet fever, Childs[166] examined the sinuses roentgenographically and found that they were clear in only 9 per cent of the cases. The sinuses were hazy in 79 per cent of the cases and opaque in 12 per cent. The frontal sinuses were not developed in 18 per cent of the cases, while there was unilateral development of the frontal sinuses in but 6 cases. The frontal sinuses were clear in 110 cases. In 123 cases the antrums and ethmoid sinuses were found to be hazy. Pansinusitis was present in 34 cases. It should be noted that maxillary infection was present in well over two thirds of all the cases. The author restudied 90 of these cases and found evidence of improvement roentgenographically in only 12 per cent of the cases. Fifty per cent of the cases revealed progression or extension roentgenographically. Baulmer is quoted as stating that the younger the child the greater the likelihood that the sinuses will be pathologically involved in cases of scarlet fever.

Dean[167] describes the advantages of closely correlating the clinical picture in sinusitis with the roentgen findings. He stresses the great importance of a careful history of the disease, cytologic and bacteriologic study of the nasal discharge and close cooperation between the rhinologist and the roentgenologist.

Cole[168] describes in detail a new application of the flat Bucky grid in the roentgenography of the sinuses. The article deals not with the value of the Bucky grid but with its adaptation to various angles.

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165. Kalteyer, F. J., and Bernstein, M.: Pan-Sinusitis (Acute) with Multiple Cranial Nerve Involvement Complicating Diabetes Mellitus: Report of Case with Necropsy, Eye, Ear, Nose & Throat Monthly **12**:447 (Dec.) 1933.

166. Childs, D. S.: Accessory Sinuses in Scarlet Fever, New York State J. Med. **33**:141, 1933.

167. Dean, L. W.: Nasal Accessory Sinus Diseases Clinically and Roentgenographically Correlated, Radiology **21**:183 (Aug.) 1933.

168. Cole, P. F.: New Application of Flat Bucky Grid to Any Angle with Special Reference to Sinus Work, Radiology **20**:1 (Jan.) 1933.

Descriptive illustrations accompany the article. Many advantages are claimed for the procedure.

Fort [169] describes in detail the use of a simple device in roentgenography of the nasal accessory sinuses which standardizes the procedure and produces excellent results. The method utilizes the Bucky diaphragm and tube stand of the ordinary roentgenographic table. The importance of true sagittal exposures for accurate interpretation is emphasized.

From the kodak research laboratories emanates a description by Wilsey [170] of some precision methods in roentgenography of the nasal accessory sinuses. An ingenious apparatus devised by Grier for leveling the head is especially featured. Illustrative photographs accompany the article.

Graham Hodgson [171] feels that roentgenograms of the sinuses should always be made in an upright position. If the prone position is used, gross pathologic changes may sometimes escape detection. The author describes six standard views which he uses. All are taken in an erect position, and for this purpose he uses his own special apparatus. The six views are the occipitofrontal view, the occipitomental view, the verticomental view, the right oblique view, the left oblique view and the lateral view. The author reports satisfactory results with this technic.

Philips [172] also advises six positions in making roentgenograms of the sinuses. The last exposure is for the frontal and ethmoid sinuses and is taken in the upright position. The other pictures are taken in the prone position.

A supplement to the roentgenogram of the sinuses is the transilluminogram by which a photograph can be made of a patient during transillumination. The Eastman clinical camera and the supersensitive panchromatic film are used for the purpose. In proposing this procedure, Wilson [173] feels that it will not in any way displace the roentgenogram. The procedure has a limited use.

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169. Fort, W. A.: Roentgenography of Nasal Accessory Sinuses; Simple Device Producing Accurate Exposures with Standard Equipment, U. S. Nav. M. Bull. **31**:289 (July) 1933.

170. Wilsey, R. B.: Some Precision Methods of Radiography of Nasal Accessory Sinuses, Radiog. & Clin. Photog. **9**:2 (July) 1933.

171. Graham Hodgson, H. K.: Sinusitis and Its Radiological Demonstration, Brit. M. J. **1**:5 (Jan. 7) 1933.

172. Philips, H. B.: A Comprehensive Roentgen Examination of the Paranasal Sinuses, Arch. Otolaryng. **17**:8 (Jan.) 1933.

173. Wilson, E. R.: Preliminary Report on Transilluminography, J. Indiana M. A. **26**:62 (Feb.) 1933.

Laskiewicz,[174] and Terracol, Parès and Bonnahon [175] have contributed also to the literature on the subject of roentgenology.

PULMONARY COMPLICATIONS

Findlay [176] is of the opinion that maxillary sinusitis in children is in many instances the etiologic factor in such conditions as bronchitis and bronchiectasis. He advises tonsillectomy followed by the intranasal operation on the antrum. He claims excellent results from this procedure both in the lessening of the chronic nasal discharge and in the amelioration of the thoracic symptoms. The relationship of the floor of the nose and the floor of the antrum in the different ages of childhood is given from an anatomic standpoint.

Wagers [177] discusses the relationship between infection of the sinuses and such general conditions as asthma, bronchiectasis, diabetes and nephrosis. He feels that in most cases the infection of the sinus is not responsible for the asthma but may be a contributing cause or even the result of a process responsible for both the asthma and the sinusitis. The diagnosis and treatment of asthma with relation to conditions of the sinuses are considered. Rackemann, Tobey, Lintz, Weille and Bishopare are quoted. They agree in most part that operations on the sinuses for relief from asthma are futile except in the intrinsic cases. The author feels also that there is a causative relationship between sinusitis and bronchiectasis. The two routes, aspiration of pus into the lungs and lymphatic drainage, are discussed. Whenever diabetes and sinusitis are coexistent, the latter should be adequately treated and eliminated, since the former will respond much better when there is no absorption of toxins from the sinuses. Sinusitis as one of the causes of nephrosis is also considered.

Rendu [178] gives 4 reports of cases of asthma cured by radical treatment of ethmoiditis.

Dr. Werner Mueller abstracted a number of the foreign articles.

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174. Laskiewicz, A.: Value of Roentgenography of the Maxillary Sinus with Iodipin and Lipiodol (Iodized Oils), Arch. ital. di otol. **44**:182 (March) 1933.

175. Terracol, Parès and Bonnahon: Diagnosis of Maxillary Sinusitis with the Aid of Substances Opaque to Roentgen Rays, Gaz. méd. de France (supp. radiol.), 1933, p. 27.

176. Findlay, J. P.: Persistent Nasal Discharge and Chest Complications in Children Due to Infection of the Maxillary Sinuses, Eye, Ear, Nose & Throat Monthly **12**:231 (July) 1933.

177. Wagers, A. J.: Upper Respiratory Tract Infections that Affect the General System, Pennsylvania M. J. **36**:250 (Jan.) 1933.

178. Rendu, R.: Relationship Between Bronchial Asthma and Chronic Ethmoiditis: Cure of Asthma by Radical Cure of Ethmoiditis; Report of Four Cases, Ann. d'oto-laryng., 1933, p. 574.

Abstracts from Current Literature

Ear

THE PROBLEM OF OTITIS MEDIA AND MASTOIDITIS IN SCARLET FEVER. JACOB I. ABRAMS and SAMUEL FRIEDMAN, New England J. Med. **209**:494 (Sept. 7) 1933.

Among the 4,215 persons with scarlet fever admitted to the South Department of the Boston City Hospital from 1928 to 1932, there were 574, or 13.6 per cent, who had purulent otitis media. Of these, 60 entered the hospital primarily for mastoidectomy. An analysis based on the total number of cases of otitis media shows practically 91 per cent occurring in the first decade of life. The peak was reached in the group 1 year of age, in which otitis media developed in almost 1 of every 2 patients (45 per cent). The percentage gradually fell until in the third decade of life it was only 1.9. The highest incidence of otitis media, both relatively and absolutely, occurred during the first four months of the year. The time of onset was: first week, 35 per cent; second week, 25.4 per cent; third week, 15.1 per cent; fourth week, 9.9 per cent; after the fourth week, 14.6 per cent.

Among the 574 cases, 210 were on the right side, 153 were on the left and 211 were bilateral. The onset in some cases was painless and without symptoms, and a discharge of pus was the first indication. Frequent otoscopic examinations are essential.

Practically all authors agree on the importance of early myringotomy. The average duration of drainage from ears in which the drum was incised was twenty-two and two-tenths days, and that of drainage from ears in which the drum ruptured spontaneously was twenty-eight days. In 26.7 per cent of the ears involved, the drum was incised, and in 63.3 per cent it opened spontaneously. Of the mastoidectomies, 25.3 per cent followed incision of the drum and 74.7 per cent followed spontaneous rupture of the drum, so that 14.3 per cent of the ears in which the drum was incised required mastoidectomy, as compared with 24.1 per cent of the ears in which the drum ruptured spontaneously.

The youngest of the patients in whom mastoidectomy was performed was aged 5 months. There were 93 males (56 per cent) and 73 females (44 per cent). Among the 166 operations, 73 were on the right side, 53 were on the left and 40 were bilateral. Of the 155 cases classified, 75 were in the group of acute involvement (first four weeks) and 80 were in the group of chronic infection. For the 75 in the first group, the average duration from the onset of otorrhea to the mastoidectomy was twelve and a half days; for the 80 in the second group, the average duration was forty-three and seven-tenths days. In the first group, the average duration of postoperative fever was five days; 18 per cent of the patients in this group had no increase in temperature. In the second group, the average duration of postoperative fever was only one and seven-tenths days; 48 per cent had no fever.

Among the 166 patients on whom mastoidectomy was performed, 9 required tying of the jugular vein for lateral sinus thrombosis. Two of these patients died, one of septicemia and septic endocarditis and the other of meningitis due to Streptococcus haemolyticus. There were 6 other deaths in the group with mastoiditis, a total of 8 deaths, making a case mortality of only 4.8 per cent. Only 1 of these deaths was in the so-called chronic group. The authors believe that the chronic otitis media and deafness due to scarlet fever might be much curtailed by the performance of mastoidectomy at the proper time.

GENGENBACH, Denver. [AM. J. DIS. CHILD.]

FISSURES IN THE BONY LABYRINTH. G. KELEMEN, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **137**:36 (Nov. 14) 1933.

Kelemen discusses the fissures observed microscopically in the bony labyrinth in some adults. He describes in particular the fissure which (in horizontal serial sections) extends from the median corner of the recessus anterior to the base of the crista in the sagittal ampulla. Its vertical extension corresponds approximately to the thickness of the ampulla. Its direction is such that together with the cochlear aqueduct it describes a narrow "V" which opens toward the posterior surface of the petrosa. Both openings are always submucous. The soft parts of the adjacent bony cavities cover them smoothly. The walls of the fissure are irregular; there are no signs of reaction in the way of a formation of bone, and no dislocation of the edges is seen. The content of the fissure is entirely independent of the soft parts of the adjacent cavities; between two fine borderlines there is a slightly calcified mass which may contain granular matter and homogeneous layers in varying proportion. The fissure extends transversely through the lamellae of the adjacent periosteal bone and the spiral blood vessels. The pathogenesis of the fissure is in no way connected with severe trauma of the skull such as fracture of the base of the skull with involvement of the petrosa. Since conclusive evidence for the vascular nature of the content of the fissure has not been presented, the author concurs with Mayers in regarding it as the result of excessive mechanical strain. Regarded in the light of Kiss' theory, the absence of a transverse lamellar system in the bone of this region and a frequently repeated increase of pressure in the surrounding bony cavities are responsible for the development of the fissure. The arrangement of the lamellae of the surrounding periosteal bone, which perhaps developed later than the fissure, suggests reparative processes that explain the special power of resistance of these places in the event of later severe mechanical trauma.

EDITOR'S ABSTRACT.

IS THERE SEPTIC OSTEOPHLEBITIS? H. J. KOBER, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **137**:203 (Dec. 11) 1933.

Whether septic thrombosis of the venules in the bone can lead to septicemia and bacteremia in the absence of sinus thrombosis is a question of importance. For a long time this possibility has been considered unlikely. Kober cites several instances of septicemia in which bacteria (hemolytic streptococci) were obtained from the blood and in which there were embolic and other signs of septicemia. Since it was not possible to demonstrate even a small mural thrombus in the sinus or bulb in all these cases, he concludes that sepsis without sinus thrombosis must be seriously considered.

EDITOR'S ABSTRACT.

ANATOMY AND CLINICAL SYMPTOMS OF CHANGES IN THE TEMPORAL BONE IN OSTEOSCLEROSIS FRAGILIS. F. ALTMANN, Monatschr. f. Ohrenh. **67**:1281 (Nov.) 1933.

Altmann reports in detail the results of a histologic examination of the temporal bone of a child with osteosclerosis, who died of pneumonia at the age of 13 months. The essential feature of the osseous changes was a disproportion between the two processes concerned in the physiologic transformation of bone. Marked deficiency in the osteoclastic destruction of old bone is accompanied by normal or somewhat increased formation of new bone. In the cartilage bone this abnormal condition manifests itself in the first anlage of ossification. On the one hand, the change of the primary medullary spaces into the definite medullary spaces occurs much more slowly than usual, and the latter appear smaller than normal; on the other hand, in the later stages the trabeculae of bone around these spaces become increasingly thicker, owing to the excess of apposition. The same tendency to increased bone formation is apparent in the membrane bone. It undergoes little transformation; the plexiform bone persists, for the most part, and new lamellar bone is deposited on it. The result is the same as in the cartilage bone: the

progressive decrease of the medullary spaces through the formation of new bone. These anatomic observations indicate that osteosclerosis is a disturbance of the growth of bone, which, according to the changes in the endochondral labyrinthine capsule, must occur in the embryo before the sixth month. The author also reports a clinical observation of osteosclerosis fragilis in a woman, aged 35. The temporal bone was unusually dense, and there was no pneumatization of the mastoid process. The author suggests that the absence of pneumatization might be due to the mechanical hindrance presented by the progressive thickening of the bone.

EDITOR'S ABSTRACT.

CENTRAL DISTURBANCES OF HEARING IN ABSCESS OF THE TEMPORAL LOBE. S. KOMPANEJETZ, Monatschr. f. Ohrenh. **67**:1322 (Nov.) 1933.

In five patients who had recovered from otogenous abscess of the temporal lobe following operation, Kompanejetz examined the hearing on the side contralateral to that of the healed abscess. He found that on the healthy side the hearing capacity for conversation is almost unchanged. Bone conduction, especially for the low tones (tuning forks, C and A), is reduced. The auditory curves for quantitative examination of the hearing capacity exhibit a drop in the region of the low tones. From these results the author draws several conclusions. Bilaterally unimpaired cochlear centers and subcortical paths are necessary for normal quantitative perception of the tones of a tuning fork. In disease of the cortical centers or of the subcortical paths of one side, a decrease in quantitative perception, especially for low tones, is found in the healthy ear. This indicates that chiefly those nerve fibers which serve for the perception of low tones are involved in the crossing of the paths of hearing. This indicates differentiated conduction in the cerebrum. The incongruity of normal perception for speech and decreased quantitative perception for low tones of tuning forks is explained by the fact that conversation, especially whispering, contains few low tones. The patient's ability to guess a word from a certain sequence of vowels and consonants also undoubtedly plays a part. The reduction of the bone conduction on the side contralateral to a healed abscess of the temporal lobe suggests that perception of sound through bone occurs not only through the peripheral terminations of the auditory nerve but also through the cerebral cortex. In bone conduction also it is the hearing of low tones which is most reduced, which further confirms the assumption of differentiated conduction in the brain.

EDITOR'S ABSTRACT.

REFLEX OF THE AURICLE. K. BERNFELD, Monatschr. f. Ohrenh. **67**:1330 (Nov.) 1933.

Bernfeld reports two observations of tactile reflex of the auricle in acute otitis media. In the first case, touching the walls of the external auditory meatus, the auricle or the retro-auricular region resulted in a slow lifting of the auricle, which could be seen at some distance. The same reflex movement was also produced merely by moving the examining finger in the direction of the auricle. This psychic reflex could be evoked only when the eyes were open whereas the tactile stimulus could cause the auricular reflex when the eyes were closed. With the attenuation of symptoms, the intensity and duration of the reflex decreased and the threshold of irritability was raised. The tactile and psychic reflexes disappeared after recovery. In the second case, the auricular reflex occurred only when the posterior wall of the meatus was touched. The reflex disappeared with the disappearance of inflammation. The author observed the tactile reflex in two similar cases and in one case of carcinoma of the middle ear, but never in a normal ear. This induces him to regard it as pathologic. Its cause is increased tonicity of the rudimentary muscle of the auricle, resulting from inflammation. The tactile reflex is independent of the acoustic reflex which has been observed. Further study may show whether it has any diagnostic or prognostic significance.

EDITOR'S ABSTRACT.

CLINICAL REPORTS OF INFLAMMATIONS OF THE PETROUS APEX. E. PRAGIER, Monatschr. f. Ohrenh. **67**:1491 (Dec.) 1933.

Pragier asks whether on an anatomopathologic basis the rarity of Gradenigo's syndrome (acute otitis media followed by paralysis of the abducens nerve and temporal pain) justifies the infrequent diagnosis of inflammation of the petrous apex. On reviewing the anatomic relations of the petrous apex, he feels that these vary sufficiently to account for inflammation without paralysis of the abducens nerve. The cause of inflammation of the petrous apex depends on the cause of the otitis, and the condition cannot be differentiated from inflammatory processes of the mastoid. One type of acute inflammation of the petrous apex coincides with the early stage of acute purulent otitis media and is shown by hyperemia of the bone, swelling of the mucosa and the presence of an exudate in the air-containing cells. The author calls this condition "petrosismus" to differentiate it from "petrositis;" it is analogous to "mastoidismus," which subsides with conservative treatment. True petrositis occurs far less frequently. If the inflammation is spread by way of the pneumatic cells in which, because of the peculiar structure of the petrous apex, resorption cannot occur, a localized purulent process develops. By rarefaction of the bone, a bony empyema then occurs. A third type of inflammation of the petrous apex belongs to the osteomyelitic processes, the infection being spread from the middle ear by way of the blood vessels. If the diagnosis is not based on the presence of paralysis of the abducens nerve, the author thinks that it will be made more often and more correctly. When abducens paralysis occurs, one must think of syphilis. A subtemporal zygomatic phlegmon can also produce symptoms suggestive of petrosal inflammation. EDITOR'S ABSTRACT.

TRAUMA SUSTAINED AT BIRTH AND ITS INFLUENCE ON THE ORGAN OF HEARING. H. BARTH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:1 (Nov. 10) 1933.

Barth studied the influence of trauma sustained at birth on the organ of hearing from the standpoint of the otologist. His investigations included: histologic examination of many temporal bones to determine the frequency and the significance of hemorrhages; clinical examination of many nurslings to ascertain whether spontaneous nystagmus may be considered as a sign of birth trauma, and examination of the hearing of ninety-six children between the ages of 7 and 12 years who had been delivered by forceps. He concludes that one has to be cautious in interpreting histologic pictures as well as in drawing conclusions as to later life on the basis of them. He did not find a single case in which deafness or baryecoia verging on deafness resulted from an abnormal delivery. He does not agree with the view that spontaneous nystagmus is a sure sign of birth trauma; it is probably a physiologic phenomenon. While birth trauma must be considered in the problem of the etiology of deafness, he thinks that it does not play nearly so important a rôle as has been ascribed to it by some investigators. EDITOR'S ABSTRACT.

CLINICAL AND ROENTGENOLOGIC CHARACTERISTICS OF OSTEITIS DEFORMANS OF THE LABYRINTHINE CAPSULE. J. BECK, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:79 (Nov. 10) 1933.

Beck says that in few diseases of the bones is the labyrinthine capsule so transformed as in osteitis deformans. Clinical examination of the hearing capacity shows a picture similar to that which is characteristic of most cases of otosclerosis. He reports a case of osteitis deformans in which this clinical picture of the hearing capacity was obtained but in which the roentgenogram showed an extensive transformation of the entire labyrinthine capsule as a part of the osteitis deformans.

EDITOR'S ABSTRACT.

INVOLVEMENT OF THE PETROUS BONE IN FRACTURES OF THE BASE OF THE SKULL. H. BIECHELE, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:293 (Nov.) 1933.

Biechele states that fracture in the region of the middle ear occurred in forty-one of seventy-four cases of fracture of the base of the skull, with involvement of the petrous bone. In none of these cases was the labyrinth included in the fracture. The chief symptom of this longitudinal fracture of the petrous bone was middle ear deafness of moderate degree which, however, receded in most cases. Temporary vestibular disturbances were noted in 40 per cent of these cases. Exact roentgenologic demonstration of the longitudinal fracture was possible in only 29 per cent of the cases in which it was attempted. Schüler's or Mayer's technic is preferable to Stenver's for this purpose. Fractures of the labyrinth (transverse fractures of the temporal bone) occurred in twenty-seven of the seventy-four cases of fracture of the skull. The course of the fissure was in every instance perpendicular to the longitudinal axis of the petrous bone; the semicircular canals, cochlea and vestibule were involved with equal frequency. Perforations of the tympanum and hemorrhages occurred in only one instance. Immediate total loss of hearing occurred in all but one of the cases of fracture of the labyrinth, irrespective of whether the cochlea or the semicircular canals were affected by the fracture. Absence of vestibular excitability was observed in twenty-four cases. This condition, as well as the deafness, was permanent. In three cases there was only temporary impairment of vestibular function. The fissure could be demonstrated by roentgenograms (Stenver's method) in 85 per cent of the cases. Simultaneous occurrence of both types of fracture is found in about 30 per cent of the cases. The combined fracture of the petrosa with perforation of the tympanic membrane and opening of the inner ear is one of the most dangerous forms of fracture of the base of the skull and the one most frequently requiring surgical intervention. EDITOR'S ABSTRACT.

FERMENTATION STUDIES IN OTOSCLEROSIS. GRAHE, GRIEBEL and X. WAESER, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:397, 1933.

Grahe and his associates found previously that the blood serum of patients having otosclerosis dissolves labyrinthine bone to a greater degree than other bone. This was determined by measuring the calcium and phosphorus content of the serum after twenty-four hours of action on pulverized labyrinthine bone and after the same period of action on pulverized temporal bones. Normal serum acted on both types of bone in the same way. The authors found similarly that the phosphorus content of the urine of patients with otosclerosis was higher after contact with labyrinthine bone. Normal urine again showed no difference in action on the two types of bone. Further studies made by measuring the phosphorus content of the serum and of the urine before their addition to the bone revealed that in the case of the urine the increase in phosphorus was apparent rather than real. The action of serum and that of urine on bone were found to be exactly opposite: Serum dissolves bone and thereby acquires a higher phosphorus content, while urine loses phosphorus to bone, although it has a higher initial content than the serum. Determinations of the phosphorus content of serum and urine made at frequent intervals after their addition to bone indicated that the reaction occurs rapidly. The authors adduce this as evidence that the reaction is due to fermentative action rather than to true solution, in which the reaction would show gradual progress until saturation was reached. EDITOR'S ABSTRACT.

Pharynx

SURVEYS ON TONSILLOGENOUS SEPSIS (CONTRIBUTION TO PATHOGENESIS, PATHOLOGY AND CLINICAL ASPECTS). L. HAYMANN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:288 (March 12) 1934.

Haymann found that in about 12,500 necropsy records examined, death following tonsillar sepsis was reported in about 5.3 per thousand. Forty-eight per cent

of the patients were men, and 52 per cent, women. They ranged in age from 15 months to 74 years. Forty per cent of the deaths occurred in the third decade and 27 per cent in the sixth, seventh and eighth decades combined. In 43 per cent of the cases, the sepsis developed from the right tonsil, and in 47 per cent from the left, and in 10 per cent it had to be considered as arising from both sides. In general, in the presence of bilateral but unequal tonsillar infection, sepsis was more likely to develop from the more seriously involved side. In about 30 per cent of the cases no recognizable harmful condition of the tonsils appeared to exist, but general sepsis resulted. In about 35 per cent peritonsillar or retropharyngeal abscesses were present. Edema of the glottis was observed relatively rarely, in severe cases only. In about 10 per cent of the cases the infectious process was established in the endocranium. In 2 cases cavernous sinus thrombosis occurred, in 1 instance combined with meningitis. In 12 cases there was more or less severe thrombosis of the jugular vein. In 3 of these cases other veins also were thrombosed. Three other cases showed phlegmons of the neck. Isolated partially purulent thrombotic processes in the region of the retrotonsillar veins were found in 3 cases. Mediastinitis was observed in 3 cases. Frequently (in about 63 per cent of all cases) metastases occurred. These were located most frequently in the lungs and less frequently in the kidneys, spleen, prostate, bladder, testicles and heart, in the order named. The soft tissues and joints were affected by metastases in only about 10 per cent of the cases. Bacteriologically the usual purulent cocci were found for the most part. In 20 per cent of the cases no organisms were found, in 68 per cent, streptococci, some growing anaerobically, were obtained. The duration of illness after the onset of septic symptoms was less than two weeks in 72 per cent of the cases.

The author suggests a method of classifying the mode of origin of tonsillogenous sepsis: (1) by direct entrance of the causative agent into the blood stream without preexisting thrombophlebitis, from isolated thromboses of the retrotonsillar veins or from a progressive jugular thrombosis; (2) by indirect entrance into the blood stream by way of lymphangitic or lymphadenitic changes, (3) by phlegmonous changes, especially in the interstices of the neck, with secondary thrombosis of the veins, especially the jugular.

EDITOR'S ABSTRACT.

PNEUMOCOCCUS TYPES IN THE THROAT. E. WIRTH and E. BRANDER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:352 (March 12) 1934.

Wirth and Brander investigated the frequency and clincal significance of the types of pneumococci isolated in 218 cases of operatively removed tonsils. Immediately after the removal a small piece was cut out from the capsule side, washed in physiologic solution of sodium chloride, cut into small pieces with sterile instruments and mixed with physiologic solution of sodium chloride in a Petri dish. From the smaller pieces sedimenting in the dish, blood agar plates were streaked and white mice inoculated intraperitoneally. The typing was done according to the method of Park. Pneumococci were found in 63.5 per cent of the hypertrophic pharyngeal and palatine tonsils and in about 13 per cent of the palatine tonsils removed because of chronic recurrent tonsillitis. All of the pneumococci from the tonsils could be typed. Types I and II occurred only rarely. In 15.1 per cent of the hypertrophic tonsils pneumococci of type III were found, and in 42.8 per cent pneumococci of group X. The individual types of group X varied considerably in frequency and virulence for mice. Types VI, VIII and XIX predominated. Pneumococci were found most frequently in the tonsils of children aged under 10 years. With increasing age the incidence of the organism decreased. It was impossible to establish any unquestionable connection between certain types of pneumococci in the tonsils and clinical observations. Pneumococci appear to be without significance in acute postoperative and pseudomembranous angina as well as in chronic recurrent palatine tonsillitis. Hemolytic streptococci play a much larger part. In general, the pneumococci found in these cases may be considered to play a saprophytic rôle, though they can, under certain circumstances, become dangerous.

EDITOR'S ABSTRACT.

Larynx

THE LYMPHATIC SYSTEM IN RELATION TO RECURRENT PARALYSIS OF THE LARYNGEAL NERVE SECONDARY TO CANCER OF THE BREAST. H. W. SCHWARTZ, J. Laryng. & Otol. **49**:221 (April) 1934.

Schwartz reports the case of a woman, aged 25, who in September 1930 discovered a small lump in the upper and outer quadrant of her left breast. Three months later this was removed and was considered benign by the pathologist. The wound healed promptly, only to break down after five months, giving rise to an ulcerated area which steadily increased in size. During July 1932, enlarged lymph glands were noticed in the axilla. A biopsy was done and carcinoma was diagnosed. In October, she consented to receive a course of high voltage roentgen therapy. Two months later she was admitted to the hospital with a discharging sore of the left breast and a swollen and painful neck. The condition in the neck persisted for about two weeks, during which the patient experienced hoarseness and a choking feeling at times, together with some difficulty in both swallowing and breathing. She had had a dry cough for three months.

Inspection showed her to be well nourished and of normal color. Examination revealed an ulcer of the breast 1½ by 2 inches (3.7 by 5 cm.) with a ragged, indurated and reddened margin, a sloughing base and seropurulent discharge. The left axillary glands were enlarged; the left supraclavicular glands were palpable, with more or less general swelling of the deep tissues of the neck. Physical examination showed the lungs to be apparently normal. Roentgen examination of the spine and long bones gave negative results, while that of the lungs suggested the possibility of malignant involvement. Laryngeal examination showed a completely immobile left vocal cord with no evidence of new growth.

Following a course of high voltage roentgen therapy the patient was discharged on Jan. 19, 1933, improved so far as the neck and throat were concerned. The fulness of the neck had subsided, but the glands remained tender. The patient was readmitted on March 19, with severe dyspnea. Fluid was aspirated from the left pleural cavity, and temporary relief followed. Distress soon recurred, and death took place the following day. Permission for autopsy was refused.

On the basis of a review of sixteen previously reported cases plus his own case, the author is inclined to believe that the infection generally travels along the substernal route or by way of the axilla and infraclavicular glands to reach the internal jugular chain, which in turn has as an afferent path the paratracheal distribution. On the right side the jugulosubclavian angle is much on the level of the lower border of the right subclavian artery; consequently retrograde extension must pass horizontally inward or probably upward in order that a gland be involved to make pressure on the recurrent laryngeal nerve, whereas extension either upward or downward would fulfil the requirements of the left side. Rouvière believes that at the level of the left innominate (brachiocephalic) vein there is a definite and constant connection between the right and left paratracheal lymphatic chains. This may be the route taken to give rise to crossed paralysis. If the right paratracheal glands were infected, the cancer cells could pass to the left side at this level and the recurrent nerve be interfered with without widespread mediastinal disease. Again, the substernal or internal mammary chain can be connected at various levels behind the sternum, or the intermammary cutaneous plexus may play a part.

EDITOR'S ABSTRACT.

A NEW METHOD OF OBSERVING VIBRATIONS OF THE TRUE VOCAL CORDS. H. WEIDEMANN, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **138**:41 (March) 1934.

Observation of the vibrations of the vocal cords by means of the stroboscope is not satisfactory in most pathologic conditions. Weidemann believes that a suitable method must follow the single vibrations from beginning to end, must extend only over a short period of time and must not necessitate a constant rate

of vocal cord vibration. The use of a photo-electric cell was tried. This could follow rapid changes in illumination, was sensitive enough and allowed a differentiation of the two cords. This method was worked out in some detail, and a few typical curves of vibration were reproduced. Further work is being directed toward the development of the best simple optical apparatus for observations on human beings.

EDITOR'S ABSTRACT.

GOLD TREATMENT OF TUBERCULOSIS OF THE LARYNX. J. BECK, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:253 (March 12) 1934.

Beck treated sixteen patients who had pulmonary tuberculosis associated with tuberculosis of the larynx with a gold preparation (aurothioglucose in oil). In two cases treatment had to be discontinued because of early unfavorable reactions. Of the remaining fourteen marked improvement of the pulmonary process and of the laryngeal condition occurred in seven. In some of the remaining patients the condition was stationary, and in some it became definitely worse. Small doses were used in all instances. The urine must be carefully watched for evidence of irritation of the kidneys. The author is uncertain whether in the cases presenting improvement of the larynx, the improvement is due to the direct action of the gold compound or to the relief from cutaneous infection resulting from improvement in the pulmonary condition. In any case, the course of the processes in the lungs and the larynx often appeared to be parallel. He concludes that according to present knowledge treatment of tuberculosis by means of gold compounds is a nonspecific, irritant therapy. In cases of tuberculosis of the larynx this treatment sometimes yields good results and sometimes bad; so great individualization should be used, with care and with small doses. The best results are apparently obtained in the infiltrating form, and much poorer results in the ulcerating form.

EDITOR'S ABSTRACT.

RELATIONSHIP BETWEEN PULMONARY AND LARYNGEAL TUBERCULOSIS. A. BRÜGGEMANN and C. AROLD, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:337 (March 12) 1934.

Brüggemann and Arold studied 289 patients with concurrent pulmonary and laryngeal tuberculosis. These patients could be divided into two groups. In one (consisting of 205 patients) the laryngeal tuberculosis developed following known pulmonary tuberculosis of greater or lesser duration. In the other group (84 patients) the symptoms of laryngeal tuberculosis began suddenly without previous knowledge on the part of the patient of preexisting pulmonary disease. So far as could be determined from the roentgenograms and from clinical or pathologic anatomic observations, most of the first group received their infection by the bronchial route, and most of the second by the hematogenous route. In the group of bronchiogenic infection the tuberculous process involved the intralaryngeal space especially; in the hematogenous group the entrance to the larynx was more frequently the site of origin. The further development of the laryngeal process involved a spread outward in the bronchiogenic type and from inward in the hematogenous.

EDITOR'S ABSTRACT.

Nose

INTRANASAL VIRULENCE OF PNEUMOCOCCI FOR MICE. L. T. WEBSTER and A. D. CLOW, J. Exper. Med. **58**:465, 1933.

Smooth colony pneumococci freshly isolated from human beings and instilled in small doses into the nasal passages of special mice raised under standard conditions brought about a characteristic infection, and this spread to healthy contacts, inciting in them either a fatal infection or development of the carrier state. The response of individual hosts to the same dose of a given culture ranged from

a completely refractory or nasopharyngeal carrier state, or a local cervical lymphadenitis, to fatal lobular or lobar pneumonia with or without pleurisy, empyema and pericarditis, and acute fatal septicemia. The pneumococci exhibited consistent individual strain differences with respect to ability to infect when instilled intranasally into mice, and also differences in spread to contacts. The degree of intranasal virulence paralleled the demonstrable ability to spread to contacts. The degree of intranasal virulence did not parallel the degree of intraperitoneal virulence for 50 per cent of the strains—high intranasal virulence was accompanied by either high or moderate intraperitoneal virulence, and low intranasal virulence by high, moderate or low intraperitoneal virulence. Type III strains were of relatively high intranasal and intraperitoneal virulence; type II strains were mostly of low intranasal but of high or moderate intraperitoneal virulence. Most strains of other types were of low intranasal as well as low intraperitoneal virulence. The intranasal virulence of the pneumococci was not enhanced by passage through animals. Nasal passage reduced the intranasal virulence to zero but did not affect the intraperitoneal virulence, form of colony and agglutinative specificity. Intraperitoneal passage maintained the characteristic level of the intranasal virulence for a period, increased the intraperitoneal virulence in some instances, but did not affect the form of colony or the agglutinative properties.

AUTHORS' SUMMARY. [ARCH PATH.]

MUCOCUTANEOUS LEISHMANIASIS OF THE NASAL CAVITY. G. FALCHI, Gior. ital. di dermat. e sif. **74**:1109 (Oct.) 1933.

Mucocutaneous manifestations of leishmaniasis are not observed exclusively in Central and South America, nor are they always due to Leishmania americana. Falchi reports a case of an ulcer of the right nostril and septum in a man aged 40, a native of Italy who had never been abroad. The diagnosis was confirmed by the presence of Leishmania in the smears and in the tissues.

PARDO-CASTELLO, Havana, Cuba. [ARCH. DERMAT. & SYPH.]

VENOUS THROMBOSIS, PYEMIA AND SEPTICEMIA IN FRONTAL AND MAXILLARY EMPYEMA AND IN ISOLATED THROMBOSIS OF THE EMISSARY VEINS. P. KONIETZKO, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **138**:20 (March) 1934.

Konietzko describes the case of a woman, aged 22, who complained of nasal symptoms and headache in the frontal and occipital regions. The nasal septum deviated to the left. Pus was found in the right middle nasal duct, but puncture and irrigation of the right antrum revealed nothing. Septic symptoms developed, but the patient recovered. It was believed that the pyemia developed from venous thrombosis in the right frontal sinus by way of the longitudinal sinus. The thrombus was removed at operation. Another similar case of septicemia and venous thrombosis resulting from chronic infection of the antrum is described. Finally the author mentions a case of isolated thrombosis of the emissary veins with septic fever. In some of these cases the patient can be treated successfully by removing the infected thrombus surgically.

EDITOR'S ABSTRACT.

PREVENTION OF COMPLICATIONS AFTER NASAL OPERATIONS. F. NOLTENIUS, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **138**:25 (March) 1934.

Noltenius observed such a small number of complications following about 600 nasal operations that he thought it advisable to publish his preventive methods. In only one case did a severe febrile complication occur, and in ten cases there were milder ones. The principle of prevention was simple: As long as the patient was unable to breathe freely through the nose, a moistened gauze mask was kept over the mouth. This procedure was pleasant for the patient and markedly reduced the number of complications even under the adverse climatic and sanitary conditions under which these operations were performed.

EDITOR'S ABSTRACT.

Miscellaneous

LOCALIZED OSTEITIS FIBROSA OF THE SUPERIOR MAXILLA. G. KRIEGSMANN, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **137**:31 (Nov. 14) 1933.

Kriegsmann calls attention to the fact that osteitis fibrosa which usually assumes a generalized form may rarely be localized in the skull, especially in the superior maxilla. He reports a case of osteitis fibrosa of the superior maxilla in a girl, aged 15, in whom no osseous changes appeared in the rest of the skeleton. The patient exhibited a swelling of the right cheek which had developed gradually during the six months preceding the examination. The swelling was most severe two fingerbreadths from the right nostril. The soft parts were not edematous, red or sensitive to pressure, and were mobile. The corpus of the maxillary bone protruded toward the front. In the canine fossa there was a smooth protuberance extending from the first premolar to the second molar. A roentgenogram of the nasal sinuses showed a strong, even clouding in the region of the right maxillary sinus. Introduction of fluid into the sinus could not be accomplished because of strong resistance. In a typical operation on the maxillary sinus, made because of a tentative diagnosis of osteosarcoma, it was found that the space usually occupied by the maxillary sinus was filled with a spongy bone which was continuous with the walls of the sinus. The soft spongy bone was removed to form an opening of the size of a normal maxillary sinus. Microscopically, the excised bone showed nothing suggestive of sarcoma, but presented a regular proliferation of osteoid tissue and active transformation characteristic of osteitis fibrosa. No exacerbation of the patient's condition has occurred in the four years since operation. Differentiation between osteitis fibrosa and osteosarcoma is possible only by microscopic examination.

EDITOR'S ABSTRACT.

TESTS FOR MOTOR DISTURBANCES OF THE SOFT PALATE. BÉLA FREYSTADTL, Klin. Wchnschr. **10**:406 (Feb. 28) 1931.

In complete peripheral paralysis the soft palate does not move voluntarily or involuntarily. Voluntary motion can be tested for by asking the patient to say "Ah" and watching to see whether the soft palate rises well or only slightly. In pyramidal paralysis, voluntary function is paralyzed, as in phonation, whereas involuntary function continues. Involuntary motion may be tested by observing reflex swallowing movements. Touching the center of the posterior pharyngeal wall usually causes contraction of the muscles of the soft palate. When persons are insensitive to this test, the epiglottis may be touched, for with the adduction of the vocal cords there also sets in contraction of the velum. In lesions of the extrapyramidal tract, both voluntary and involuntary movements can be carried out but speech becomes nasal.

With paralysis of the soft palate it becomes practically impossible to puff out the cheeks. If a patient with marked nasal speech cannot puff out his cheeks, the lesion is either of the peripheral nerves or of the pyramidal tract. In these cases closing the nose will enable the patient to carry out this movement, but when the nose is released the air rushes out and the cheeks become flattened.

Puffing out of the cheeks tests also the functional integrity of the orbicularis oris muscle.

SILVERMAN, Syracuse, N. Y. [AM. J. DIS. CHILD.]

EXPERIMENTAL STUDIES ON METAPLASIA. R. BAER, Monatschr. f. Ohrenh. **67**:1437 (Dec.) 1933.

Change in the character of the tracheal epithelium from the ciliated to the pavement type is the subject of this article. Such a change has been reported to occur in the neighborhood of syphilitic or tuberculous ulcers of the trachea, in the entire trachea of patients with influenza and in the trachea as far as the bifurcation in chronic cannula-carriers after tracheotomy. The change must be due either to

embryonal rests in the trachea or to metaplasia. Baer attempted to confirm the experimental observations of others in developing pavement epithelium in the trachea. He was unable to do this in guinea-pigs by means of prolonged inhalation of chloroform and ether. In only one of twenty-one rabbits in which a metal or a rubber tube or simple evagination was used following tracheotomy was a change from ciliated to pavement epithelium obtained. In two large dogs, however, each of which carried a metal cannula in the trachea for eighteen weeks, a true change from cylindric to pavement epithelium was obtained. The tracheal epithelium of two human patients who had worn tracheal cannulas for only a few days showed no change, but a patient who had worn a cannula for eight years had definite pavement epithelium in the trachea. The author's opinion is that this process is true metaplasia resulting from long continued unphysiologic direct action of the air. A considerable period of time is necessary for the occurrence of the metaplasia.

EDITOR'S ABSTRACT.

THREE FALSE DIAGNOSES. E. WESSELY, Monatschr. f. Ohrenh. **68**:56 (Jan.) 1934.

Wessely describes an unusual case in which in the course of three years three wrong diagnoses were made. The first was tuberculosis of the larynx. Because of certain atypical observations, resort was made to histologic examination. The histologic picture in conjunction with a positive Wassermann reaction resulted in a diagnosis of a rare syphilitic gumma of tertiary syphilis. A short time later an ulcer appeared on the tongue, which was considered tuberculous. Biopsy showed this to be a carcinoma. About two years later the patient was brought into the clinic with painful swallowing and high fever. The cause was originally considered to be a retropharyngeal abscess. The patient died, and at autopsy a degenerated basal cell carcinoma was found.

EDITOR'S ABSTRACT.

LIPOMA-LIKE TISSUE OF THE LEFT BRONCHIAL TREE. A. HONIG, Monatschr. f. Ohrenh. **68**:155 (Feb.) 1934.

Benign tumors of the deep respiratory apparatus are rare. Honig describes such a tumor in a man, aged 54, who had had chronic cough for fourteen years and had intermittent fever and bronchiectasis. At necropsy an egg-shaped tumor about 5 by 4 cm. was found extending into the mediastinum from the left bronchial tree. On the basis of histologic examination of serial sections the tumor was found to be a lipoma-like hamartoma arising from the submucosa of the membranous portion of the left bronchial stem. Because of its benign nature it grew not only out toward the bronchial lumen, which is at this point free from cartilage, but toward the posterior mediastinum, making a fibrous capsule as it grew. As a result of the total closure of the bronchial lumen, bronchiectasis resulted which led to the fatal outcome.

EDITOR'S ABSTRACT.

STRUCTURE OF THE BRONCHIAL TREE. E. HUIZINGA, Ztschr. f. Hals-, Nasen- u. Ohrenh. **33**:534 (Oct. 14) 1933.

Huizinga states that roentgenography of the thorax with iodized poppy-seed oil as a contrast medium is an excellent method for the study of the anatomic structure of the bronchial tree. He recapitulates the views concerning the structure of the bronchial tree that have been advanced since Aeby's theory and discusses the recent investigations of Marcus and Hilber, who demonstrated a spiraliform structure. He was able to confirm the observation of the spiraliform structure of the bronchi in stereoroentgenograms.

EDITOR'S ABSTRACT.

TUBERCULOSIS OF THE SALIVARY GLANDS. G. APFELD, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:152 (Feb. 10) 1934.

Tuberculosis of the salivary glands is rare. The parotid gland has been more frequently involved than any of the others. Apfeld finds that tuberculosis of the salivary glands is usually a purely localized disease. Because of its rarity and lack of definite characteristics it is difficult to diagnose before operation. Three possible routes of infection must be considered: by the blood stream, by the lymphatics and by ascension through the duct from the mouth. The author feels that the available evidence points to the blood stream as the most common source. Perhaps infection from the mouth by way of the parotid duct occasionally plays a part.

EDITOR'S ABSTRACT.

CIRCUMSCRIBED FACIAL HYERHIDROSIS. A. I. GESCHELIN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:168 (Feb. 10) 1934.

Geschelin describes the case of a patient, aged 22, who had suffered from increased perspiration of the face, especially the left side, for nine years. This was especially marked during eating. Chewing a piece of herring, for example, caused great drops of sweat to appear on the face, neck and upper part of the thorax. Drinking water caused only slight hyperemia of the face. The patient had typhus in 1920, which was complicated by bilateral inflammation of the left parotid gland for which surgical intervention was necessary. The author agrees with Vogel as to the essential sympathetic-parasympathetic mechanism but thinks that much detail remains to be clarified.

EDITOR'S ABSTRACT.

ROENTGENOLOGIC OBSERVATIONS OF THE SKULL AND LARYNX OF DEAF-MUTES. J. DILLON, B. PREOBRASCHENSKY, S. WULFSON and G. FOMIN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:219 (Feb. 10) 1934 .

Dillon and his co-workers studied the skulls and larynges of sixty deaf-mute children by roentgenography in an attempt to determine whether there were any typical anatomic characteristics. The children ranged in age from 9 to 17. There were twenty-five boys and thirty-five girls, who were divided into groups. The first consisted of thirty-nine children with inborn deaf-mutism; the second, of sixteen with acquired deaf-mutism but without visible otoscopic changes, and the third, of five with acquired deaf-mutism and with otoscopically demonstrable destructive changes in the middle or outer ear or the mastoid process. Special reference was made to the synosteosis of the cranial sutures. It was found that the coronary sutures were missing in 36.8 per cent of group 1 and in 30 per cent of groups 2 and 3. The authors conclude that in cases in which the bone is influenced by increased osteogenesis, an increased pressure is exerted on the growing brain which can produce a deformity of the skull. Just what is the relationship of these observations to deaf-mutism the authors do not know, but they believe that the process exerts an unfavorable effect on the further development of deaf-mutism. With regard to the pneumatization of the temporal bone, it was found that except for the third group, who presented a condition in which mastoid sclerosis is usually found, there was no essential difference from the normal. Roentgenography of the larynx was carried out by taking the picture from the side in such a way that the two halves would coincide when the films were developed. For this purpose the patients were divided into three groups according to age, i. e., 9 to 12, 13 to 15 and 16 to 18. The authors conclude that there is at first too little use and later too much use of the larynx. This may be the origin of the early wear and tear of the larynx but is based on an unfavorable constitutional predisposition.

EDITOR'S ABSTRACT.

INVESTIGATION OF JUGULAR PRESSURE AND ITS CLINICAL IMPORTANCE. O. MUCK, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:362 (March 12) 1934.

The differential diagnosis of pyemic fever after antrotomy or antrectomy is often difficult. Such fever is not always due to sinus or jugular thrombosis. Muck suggests a method of helping to eliminate jugular thrombosis in some instances. In man when a venous hum can be heard over one jugular vein there is an increase in this murmur when the head is pulled sideways so that the jugular vein of the other side is brought closer. This murmur, however, is frequently absent. He found that in the second decade of life spontaneous venous murmurs are frequent (85 per cent). When this phenomenon can be elicited an occluding jugular thrombosis is thus eliminated. Two cases are cited in which this was done. Naturally it is only the positive elicitation of this sign which is of clinical value.

EDITOR'S ABSTRACT.

SIGNIFICANCE OF ROENTGENOGRAPHY IN THE DIAGNOSIS AND THERAPY OF HYPOPHYSEAL TUMORS. G. SPIESS, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:365 (Nov.) 1933.

Spiess states that whereas roentgenographic demonstration of enlargement of the sella turcica is usually required as an indication for operation for hypophyseal tumor the absence of this sign (in sagittal roentgenograms) does not preclude the presence of a tumor. This is illustrated by a case in which the author performed Hirsch's hypophyseal operation on the basis of ophthalmologic observations, and at the request of the patient in absence of roentgenographic evidence of enlargement of the sella turcica. No tumor was discovered at operation. Persistence of the ophthalmologic symptoms led him to intervene a second time five weeks later. This time the whole septum was resected, exposing the entire sphenoid sinus. A portion (about the size of a pea) of a tumor had prolapsed into the bone space which had been made at first. This was excised, together with other portions of a deep, massive, noncystic tumor. Recovery was uncomplicated. Although the tumor was not completely removed, the decrease in pressure resulted in improved vision and, for the time being, averted the danger of loss of sight. The diagnosis of a hypophyseal tumor should not be dependent on the roentgenographic picture alone; it requires the collaboration of the internist and the ophthalmologist.

EDITOR'S ABSTRACT.

Society Transactions

MASSACHUSETTS EYE AND EAR INFIRMARY, OTO-RHINO-LARYNGOLOGICAL SERVICES

EDITED BY PHILIP E. MELTZER, M.D.

Regular Clinical Meetings, Dec. 1, 1933, to March 31, 1934

POSTOPERATIVE SUBMUCOUS RESECTION: HEMORRHAGE AND INFECTION. DR. D. K. JUDD and DR. H. G. TOBEY.

This 22 year old man underwent a submucous resection in the outpatient department eight days ago. There was considerable bleeding at the time of the operation which necessitated packing. Finger cots were placed in the nose, and the patient was sent to the emergency ward. The next morning the cots were removed, but the bleeding continued and petrolatum strips were placed in the nose. On the following day there was a rise of temperature to 101 F., with considerable swelling of the lip and nose. The petrolatum strips were removed immediately, but this was followed by a tremendous hemorrhage which necessitated their replacement. That afternoon the temperature rose to 104.5 F. The patient continued to have high temperature and a rapid pulse and appeared very ill. Six days after operation Dr. Tobey removed all the packs from the nose and replaced them with 50 per cent dextrose strips, and the hemorrhage was stopped.

Physical examination and neurologic examination gave negative results. The patient continued to have a temperature varying from 103 to 105 F. The white blood cell count rose to 17,000 but later dropped, so that at present it is 7,000. The red cell count dropped from 5,000,000 to 3,200,000. The patient was tested for transfusion, but it was not necessary to give one to him. There are marked infiltration and blueness of the upper lips, extending into the cheeks. There is considerable swelling of the pharyngeal wall, and the palate is edematous. The patient is now more comfortable than he has been, but he still has fever.

DISCUSSION

DR. H. G. TOBEY: Evidently this man had a beginning acute infection on the day of his operation. This was simply an unfortunate complication, with no one particularly at fault. The point of interest to me is that the dextrose solution stopped the hemorrhage.

DR. E. W. HERMAN: When a patient is on the table and ready for operation, if one suspects beginning acute infection it is no disgrace to stop. This procedure has saved me several times from encountering a condition such as that just described.

DR. G. B. FRED: I observed a case in which local submucous resection was followed two days later by acute sepsis and a temperature of 105 F.; the patient now has ankylosis of the hip joint. There was no acute infection at the time of operation.

DR. P. E. MELTZER: Does the surgeon who performed the operation know where the hemorrhage came from?

DR. H. G. TOBEY: Answering for the surgeon, I believe that it came from the anterior palatine foramen. That is where my dextrose strip was placed, and it seemed to control it.

RIGHT SIMPLE MASTOIDITIS WITH ABSCESS OF THE PHARYNGOMAXILLARY SPACE. DR. H. G. TOBEY.

A man, aged 68, entered the hospital on Dec. 7, 1933, complaining of discharge from the right ear for over three weeks; he was not aware of the exact duration. Roentgen examination showed destruction in the mastoid tip and over the sinus. Although there was no complaint referable to the throat, it was noted on examination that the soft palate and supratonsillar region on the right side were very boggy and that the tongue protruded slightly. The bogginess was present for several weeks. On the day following admission a right simple mastoidectomy was done by Dr. G. Poirier. The cells were completely decalcified; there was no definite pus, but the cells contained granulations. The swelling in the throat became more marked, and the patient was transferred to the laryngologic service.

Ten days after admission, the swelling in the throat was incised, but no pus was obtained. This was repeated three days later, but still there was no pus. Facial paralysis appeared and became more marked. A neurologic consultation two weeks after admission resulted in a report of paralysis of the seventh and twelfth nerves, and the question of a malignant growth of the nasopharynx was brought up. The next day a tracheotomy was done because of increasing dyspnea resulting from the swelling. The larynx was normal. Meanwhile the mastoid wound healed completely.

Several biopsy specimens were taken from the nasopharynx and the region of the right eustachian orifice, but all showed only edema and infection.

Twenty-two days after admission the patient had a severe chill and fever, the temperature reaching 103 F. The next day the postaural wound and the middle ear began to discharge again, yielding thick, yellow, foul pus. The chills recurred daily for several days. There was no jugular tenderness, and blood cultures were negative.

The swelling of the palate was reopened three days after the postaural wound began to discharge, and a hemostat was forced in for at least an inch (2.5 cm.). No pus was obtained, but later, when the patient sat up in bed, a large quantity of thick, yellow pus was discharged from the right nostril. This discharge continued from that time on. A swelling of the neck over the right angle of the mandible slowly appeared, and on Jan. 4, 1934, one month after admission to the hospital, an exploration of the right side of the neck was done in an attempt to locate an abscess. The fascial planes were followed up beneath the parotid gland into the pterygomaxillary fossa, but no pus or fluctuation could be found, even with counter-pressure with the finger in the nasopharynx. Then the soft palate was divided to expose the nasopharynx. The swelling of the right posterior portion of the nasopharynx was freely incised and followed upward to the under surface of the sphenoid. Pus was obtained. The patient was considerably improved after this, but a large amount of pus was discharged from the nasopharynx and through the right nostril. The wound in the neck healed, but an edematous swelling persisted below the right ear and gradually extended behind the ear.

By January 18, one and one-half months after admission, pressure over the area of the swelling caused pus to well up into the postaural wound. A blood transfusion was given, and the next day the patient was operated on again. The postaural incision was continued down the neck beneath the mandible. A definite lead was found upward from the neck beneath the mastoid process to the styloid process. This space contained pus. The sternocleidomastoid muscle was divided to expose the cavity freely. After removal of granulations from the mastoid cavity, a defect was found extending anteriorly through the tip in the region of the facial nerve. The tip was necrotic and was removed. The styloid process, which was thus exposed, was loose and came away as a sequestrum. The jugular bulb was thrombosed. Considerable tissue was sent to the laboratory for biopsy, but there was no evidence of a malignant process. The wound was left open, and it continued to discharge thick, yellow, extremely foul pus.

NOTE.—The patient's condition remained poor, being improved only temporarily after transfusions. Three of these were given. Increasing difficulty in swallowing developed, although definite paralysis of the muscles of deglutition did not occur. Hypodermoclysis and intravenous injections of dextrose, frequent irrigations of the wound in the neck with surgical solution of chlorinated soda and similar measures constituted the treatment. He gradually became weaker and lost weight, and on March 1 he died.

DISCUSSION

DR. H. G. TOBEY: All I could make out was slowly necrosing osteomyelitis of the base of the temporal bone and possibly of the skull. The whole posterior canal wall and the entire canal and mastoid came away as a sequestrum. Following that, the styloid process came away as a sequestrum, and bare bone could be felt in the foramen magnum. All of the tissues were necrotic. Why meningitis did not develop is not known. Certainly all efforts to find a malignant process failed.

TOTAL LARYNGECTOMY. DR. J. R. FRAZEE and DR. LEON E. WHITE.

Total laryngectomy for grade 1 carcinoma of the larynx was performed on this man, a 62 year old clerk, who was admitted to the laryngologic service on March 5 with a history of gradual onset, with slowly progressive hoarseness over a period of eighteen months. There was no weakness, loss of weight or difficulty in swallowing. Three weeks ago a Lynch suspension was done under ether anesthesia by Dr. White. This showed a fairly large, irregular mass involving the right cord and the region just below the cord. There was no involvement of the ventricle, opposite cord, arytenoids or pyriform sinus. The cords moved equally and well. A biopsy specimen was taken which showed grade 1 carcinoma.

One week later (two weeks ago) a tracheotomy and first stage laryngectomy were done under ether anesthesia by Dr. White. The midline route was used from the hyoid bone to just above the suprasternal notch. The muscle and fascia were retracted. The larynx was exposed, the thyroid isthmus clamped and cut, the cricoid cartilage cut anteriorly and a no. 6 tube inserted. There was little reaction following this. Eight days later the operation was completed with the second stage. With the patient under avertin and ether anesthesia Dr. White extended the original incision upward 1 inch (2.5 cm.). The hyoid bone was cut, and the thyrohyoid membrane was separated from the bone. The trachea was cut through at the level of the tracheotomy. The larynx was elevated and separated from the esophagus by blunt dissection and from the hypopharynx by cutting through the mucous membrane with scissors. The membrane of the hypopharynx was closed with continuous catgut sutures. A long no. 6 tracheotomy tube was inserted and also a feeding tube. Skin clips were put in, and silkworm gut mattress sutures were inserted just above the tracheotomy tube.

Following the operation the patient did well. There was practically no temperature. A little air was present subcutaneously over the cheek and neck, which has gradually subsided. There has been a little gaping of a portion of the wound since the skin clips have been removed. The feeding tube has been in place since last night. Apparently the man has had no leakage for a while, but now there is a little saliva leaking through.

DISCUSSION

DR. L. E. WHITE: In the first stage I did not suture the skin wound but left it wide open, hoping to get the granulations started so that by the time the second stage was performed the edges of skin would close nicely. But I did not succeed in that. The larynx seemed very thick, and this made its resection a little harder than in an operation which I did a year ago.

DR. H. G. TOBEY: Where did the growth seem to be?

DR. L. E. WHITE: It was on the right side below the cord.

DR. J. R. FRAZEE: From the appearance of the specimen it seems that the growth might have entered beyond the base of the epiglottis. A specimen taken showed no malignant changes in that region.

DR. L. E. WHITE: The second stage was done under avertin anesthesia.

DR. H. G. TOBEY: There seems to be more growth on one side than the other. That seems to be above the cord.

DR. L. E. WHITE: On suspension it looked as though it was below the cord.

DR. E. W. HERMAN: It would not do any harm to remove the epiglottis, especially if the growth is on the anterior commissure above the cord. In cases in which there is no actual dyspnea, it is well as a preliminary measure to do a punch tracheotomy without using the tube at the time. This enables the patient to be much more comfortable during the first few days. The wound is left open, and there is no irritation from the tube and no mucus. This is a little detail which makes the preliminary tracheotomy less unpleasant.

DEEP CERVICAL ABSCESS WITH INVOLVEMENT OF INTERNAL JUGULAR VEIN. DR. J. R. RICHARDSON and DR. M. EVANS.

History and Early Course (Dr. Richardson).—A 32 year old woman who was working in one of the wards of the Massachusetts General Hospital noticed a sore throat three days before admission to the hospital. Two days before admission she came to the clinic because of slight swelling on the right side of her neck. She was given hot irrigations and a spray for her throat, which was injected. She was seen in the outpatient department on the day of admission. The swelling on the side of the neck had cleared. The throat was still slightly injected. There was a little swelling in the tonsillar area. She was transferred to the Gardner Building (the building for patients with contagious diseases connected with the Eye and Ear Infirmary).

On admission, she had on the side of the neck, below the angle of the jaw, some tense, firm glands about 2½ inches (6 cm.) in diameter which were matted together. Under poultices and hot irrigations during the next two days these glands increased to 4 inches (10 cm.) in diameter and became slightly softened. On the side behind the tonsillar fossa the tonsil had been removed about fifteen years previously. There was swelling of the lateral pharyngeal band area. This became soft and fluctuant. The white blood cell count was 17,000, with 84 per cent polymorphonuclears.

The patient was seen by Dr. Allman, who agreed that one should incise the lateral pharyngeal wall. A 2 inch (5 cm.) incision vertically yielded 2 or 3 teaspoonfuls of clear yellow pus. Directly after the operation the patient had a chill. At this time she had a septic fever, the temperature rising to 104 F. On the following morning she felt relieved. The glands in the neck had decreased considerably in size and were somewhat softer. That evening she had a definite chill and a temperature of 105 F. She was seen the next morning. The wound in the throat was still draining slightly. The patient felt much better. She looked very toxic. She was seen by Dr. P. E. Meltzer and Dr. M. Evans, who agreed that an operation should be done. Dr. Evans operated on her and will tell about it. The illness had a fatal termination.

Operation and Subsequent Course (Dr. Evans).—The patient did not have a chill on the day on which I operated. On Saturday night the temperature rose to 106.4 F. She looked toxic although she felt well. That night I made an incision for from 4 to 5 inches (10 to 12 cm.) along the anterior border of the sternocleidomastoid muscle. When the incision passed in front of the anterior border of the mastoid considerable thick yellow pus exuded. On resecting the sternocleidomastoid I came on a mass of gangrenous tissue. None of the structures in the neck could be recognized. The jugular vein and the carotid sheaths were one mass of gangrenous tissue. On dissecting backward I came across infected glands; each gland that I opened seemed to be a separate pocket of pus. I dissected well down to the clavicle and did not make out any of the carotid structures. I finally used blunt dissection and managed to recognize what looked like the jugular vein and in it a large opening about the size of a lima bean through which pus was coming. I inserted a probe almost to the extent of the jugular

vein. When I removed the probe there was some bleeding from above. I tied off the facial vein and tied off the jugular vein above where the facial vein comes into it and just below. I also tied the jugular vein well down in the neck and took out the part of the vein between the ties. The carotid artery was now recognized, and I found it very thick and cordlike, with only slight pulsation in it. I left the wound wide open, packed with petrolatum gauze.

For about two days the patient had no chills, but she was extremely toxic. The question arose of giving a transfusion but because of the high temperature it was decided not to do so. Hypodermoclysis of 2,000 cc. of fluid was given although the patient took fluids well. She gave strongly positive Wassermann and Hinton reactions. On Tuesday morning at 7 o'clock she died. Dr. Richardson will give the autopsy report.

Autopsy (Dr. Richardson).—Examination revealed no collection of pus in the pharyngomaxillary fossa or in any other pocket. The wound showed slight drainage of purulent secretion throughout the upper area. The ties were cut off at either end of the jugular vein, and no thrombus was seen either above or below. The carotid artery was found at operation to be very thick, and the walls were definitely infected. Before death the patient had some râles in the chest, increased respiration and slightly increased cough. Death was rather sudden. At autopsy the lungs were filled with infarcts. There was a definite thrombus as well as evidence of double bronchopneumonia. The heart was normal. The only other abnormal findings were of merely anatomic interest.

DISCUSSION

Dr. M. G. Evans: Blood cultures were negative, but an acute condition of the right wrist developed, with redness, swelling and pain on the lower surface.

Dr. E. W. Herman: This seems to be a case of an acute condition of the throat with sepsis involving the neck following peritonsillar abscess. There were strongly positive Wassermann and Hinton reactions and a white blood cell count of 14,000. The temperature rose to 106 F. The course showed that she had poor resistance. It seems to me that everything was done to try to block the spread of sepsis.

Dr. H. G. Tobey: Was the condition a true pharyngomaxillary abscess?

Dr. J. R. Richardson: It seemed to be a lateral pharyngeal abscess. There was a white, necrotic area on the lateral pharyngeal bands.

Meningitis or Cerebellar Abscess. Dr. P. J. Ross, Dr. G. Poirier and Dr. P. E. Meltzer.

This 22 year old man was first admitted to the hospital on Sept. 11, 1933. Two days before admission a cerumen-covered cotton plug was removed from the right ear which had probably been there for about three years. The history revealed that he had had deafness, vertigo and discharge from the ear following an automobile accident ten years previously. For the past two and one-half months he had had dizziness. His hearing was poor in the right ear. The right labyrinth was viable. On September 20, a radical operation on the right mastoid was done by Drs. Carrol and Frackelton. No cholesteatoma was found. No dura or sinus was exposed. Three days following the operation the patient had severe headache with third degree nystagmus to the opposite side. All packs were removed from the cavity, and he made a rather slow recovery following that.

He was discharged on October 6 with very slight nystagmus to the opposite side (the left) and occasional dizzy spells. He had definite hearing in the right ear, and the response to the Weber test was obtained on that side. Four weeks after his discharge he was readmitted because of increased attacks of dizziness and some pain on the top of the head. He has been under observation for twenty days. The caloric test with 150 cc. of ice water failed to elicit any response. There is no hearing in the right ear. The left ear is normal. The cavity left by

the radical operation on the right mastoid was filled with granulations and when these were pressed with a cotton probe definite rotary nystagmus occurred to the same side.

On November 25, Dr. Meltzer revised the cavity, removing all granulations and curretting out some of the bone around the labyrinth to smooth the surfaces. A skin graft was applied to the epitympanic and middle ear regions only. The bowl was not grafted. On the following day the patient vomited, had a slight stiff neck and presented a slight Kernig sign. Lumbar puncture was done, showing an initial spinal fluid pressure of 150 mm.; there were 320 cells per cubic centimeter, with 47 per cent polymorphonuclears. An attempt to remove the skin graft was unsuccessful. Lumbar puncture was done daily for the next three days. The initial pressure was from 150 to 185 mm., and the cells numbered from 300 to 350, being mostly mononuclears. For the next week he rapidly improved; the stiff neck, headache and vomiting disappeared. He still has a fine nystagmus to the opposite side. Lumbar puncture revealed an initial pressure of 90 mm.; there were 15 cells, 14 of which were lymphocytes. The temperature was high for three days but has been normal for the past week. He has no complaints. The skin graft is still intact in the middle ear. There is a slight mucous discharge.

NOTE.—The patient was kept in the hospital for two weeks following operation. He was discharged with a normal temperature and no symptoms other than attacks of dizziness. The cavity contained a slight mucous discharge from granulations in the bowl, but there was no odor. Because of the dizziness he was admitted to the neurologic service of the Massachusetts General Hospital because of a suspicion of cerebellar abscess, but this diagnosis was not confirmed. He returned to the outpatient department, where he was followed by Dr. Meltzer for two months. The cavity epidermized completely; all of the symptoms, including the dizziness, have disappeared, and the man is looking for and eager to secure employment. The diagnosis is chronic suppurative otitis media, circumscribed labyrinthitis and localized meningitis (?) of a nonvital labyrinth.

DISCUSSION

DR. P. E. MELTZER: The question is: What has really happened? Did he have a live labyrinth on discharge from the hospital which died during the interval between his discharge and his readmission. If so, how could nystagmus be produced by pressure on the granulations? It is possible that the granulations failed to permit transmission of cold to the labyrinth and that he still has a partially live labyrinth. On the other hand, one cannot overlook the fact that curretting of the granulations and some of the bone around the labyrinth activated a latent infection of the labyrinth and induced localized meningitis. Further, did he have a dead labyrinth with extension to the cerebellum, with a possible cerebellar abscess? If so, the best procedure would be to clean out the labyrinth immediately and explore for cerebellar abscess, but in view of the fact that he is improving and has a normal temperature and practically no symptoms, I recommend that he be left alone. Otherwise the condition will be aggravated and this time there may not be such a fortunate outcome.

DR. P. MYSEL: I think that it was poor judgment to insert a skin graft at the time of the operation in the face of a dead labyrinth with intracranial manifestations. He evidently had a stormy history.

DR. P. E. MELTZER: He had dizziness with slight nystagmus except when it subsided on removal of the packs following the radical operation.

DR. G. L. TOBEY: I should do nothing for the present, but if any meningeal symptoms reappear I should open the labyrinth.

DR. D. C. SMYTH: I still claim that one is smoking a cigaret on an open keg of gun powder. This man must be carefully watched, and, as Dr. Tobey says, if meningeal signs appear one should clean out the labyrinth.

DR. P. E. MELTZER: The reason for inserting a skin graft was that there were no signs of labyrinthine infection. He had a normal temperature, and the middle ear was filled with granulations which could easily produce the slight nystagmus to the left. The cavity was cleaned out thoroughly, and in order to prevent recurrence of granulations and shorten the convalescence, as he had been in the hospital for months, the skin graft was placed in the antrum and middle ear cavities. I believe that the curretting of the bone is just as likely to have created the disturbance, with infection which extended to the meninges, as the simple placing of a graft, for no one knows what the pathway to the meninges was.

THE HARMER OPERATION. DR. P. J. ROSS and DR. D. C. SMYTH.

This man, 65 years of age, came to the hospital with a history of hoarseness of one year's duration with complete loss of voice for two months. Biopsy showed grade 11 carcinoma of the right vocal cord, limited to that cord. The Harmer operation was done. This is the first Harmer operation performed at this institution. The operation was done about two weeks following the biopsy. Three platinum needles were carried into the window resection and left in until a total of 1,500 mg. hours was given. A tracheotomy was done preliminary to the operation. The wound in the neck healed promptly. He still has the tracheotomy tube in place. He still has some edema of that side of the larynx, but the cord is movable and is fairly smooth. He has a fairly good glottis. He has had no roentgen treatment.

DISCUSSION

DR. H. P. MOSHER: Are the presenters thinking of giving roentgen treatment?

DR. J. P. ROSS: Yes.

DR. H. G. TOBEY: Was there any change in the appearance of the cord?

DR. P. J. ROSS: There was tremendous edema of the larynx for about two weeks following the implantation of radium. He received 1,500 mg. hours.

DR. E. W. HERMAN: I prefer using 1,000 mg. hours instead of 1,500. The roentgen treatment should be started as soon as the patient gets over the acute stage.

THE HARMER OPERATION. DR. H. G. TOBEY.

The Harmer operation was performed on this patient also. Dr. E. W. Herman saw him when he had a profuse swelling of the false cord. It was blocking or hiding the true cord, and there was no outcropping into the glottis. The mucous membrane was perfectly smooth. My associates and I did not wish to remove a specimen for biopsy through the intact mucous membrane, so we decided to perform the Harmer operation. I made a curved incision laterally off the midline; the muscles were lifted away easily, and there was no difficulty in securing a good exposure. Only 1,000 mg. hours of radium was given, and we did not put in a tracheotomy tube; the patient has not had much reaction. With the incision used there was no difficulty in getting out the needles.

DISCUSSION

DR. E. W. HERMAN: I am glad to see this patient get along without a tracheotomy tube. I think that the patients will be more likely to recover without the use of a tracheotomy tube and that the results will be excellent. Heavy doses of radium are likely to lead to necrosis of the cartilage. One interesting point is that the specimen was removed through the window in the cartilage and a frozen section made there, and a diagnosis was made without touching the larynx.

DR. H. G. TOBEY: Some of the usual reaction may have been prevented by the thickness of the larynx. There was considerable carcinoma tissue to go through, and probably that is why there was not much reaction in the larynx.

SINUS THROMBOSIS. DR. J. QUINCY and DR. P. J. ROSS.

This girl, aged 16, was admitted to the hospital on Jan. 6, 1934. She gave the history that three weeks before admission she had swollen glands on the right side of the neck and pain in the right ear. She came to the outpatient department one week later, at which time the canal was very red and inflamed and the drum was thickened and dull, and there was some dried secretion in the canal. She was treated for external otitis media, and there was marked tenderness on pulling the auricle and the mastoid tip.

Two days before admission she had severe pain in the ear, and it began to yield a purulent discharge. There was considerable tenderness over the mastoid tip, and the furuncle was incised. Pus was obtained. A roentgenogram taken at that time showed slight diffuse thickening of the right mastoid, with the cell outlines intact. She came to the clinic on the following day, and on January 6 she came in with severe pain on that side of the head and exquisite tenderness over the ear and mastoid region. There was some swelling. Her temperature was 103 F.

She was admitted to the hospital that day. In a few hours her temperature rose to 105 F. She had considerable flushing of the skin. Though there was no history of chill or other localizing signs, the possibility of an acute infectious disease was thought of, such as erysipelas or perhaps scarlet fever. She was transferred to the Gardner Building, where she was followed for about four days. She quieted down following local treatment, and the temperature returned almost to normal. On January 11 a simple operation on the right mastoid was done. The cortex over the tip of the mastoid was found to be completely decalcified. There was a perforation near the posterior canal wall, and the lower part of the mastoid process was soft, though the upper part of the bone was firm. The sinus plate had become eroded at about the knee and was covered with granulations. This area was enlarged in each direction, the cavity was packed, and the patient was sent back to bed. She got along nicely for a week, and then the temperature rose to 105 F. again. There is no definite history of a chill. The temperature early in the morning was 103 F., and at noon on that day it rose to 105 F. The white blood cell count was 31,000. There was exquisite tenderness over the course of the jugular vein in the neck. That afternoon the jugular vein was ligated by Dr. Quincy, and the mastoid cavity was reopened.

DISCUSSION

DR. J. E. QUINCY: From the start we were thrown off the track, possibly by the infection of the canal wall. It is easy to understand such cases as one looks back on them. There is no question but that the patient had the jugular thrombosis early. At the first operation the sinus was uncovered, the wall looked thickened and we exposed it freely. Obviously, an infection was brewing down near the jugular bulb, and it was hidden. We did not explore the sinus deeply enough at that time; so at the second operation we took the entire tip off and found a rather gray-looking sinus. We ligated the jugular vein, opened the sinus wide and obtained free bleeding from above but not from below. The dynamics did not show a complete or even a partial block.

DR. P. J. ROSS: There was a perforation, and pus was present in the sinus.

DR. H. P. MOSHER: For the benefit of the students, simultaneous infection of the canal and the mastoid is confusing. The question that occurs to me at this time is whether there was any way in which a hint of this could have been secured a little earlier. Would roentgen examination have helped?

DR. A. S. MACMILLAN: Definitely increased density of the mastoid is shown by the roentgenogram taken six days before the operation. It was a small mastoid, with very small cells. Six days should produce some difference, but roentgen examination would not have shown any change in the sinus.

DR. P. J. ROSS: Following the second operation I obtained the history from the patient's mother that she had been in another hospital for three weeks, six

weeks before she entered here, with a severe sore throat and enlarged glands on the right side of the neck, so it is possible that the jugular sinus may have been thrombosed or infected at that time.

DR. H. P. MOSHER: One seldom observes such tenderness over the jugular vein.

DR. P. J. ROSS: Before the operation a lumbar puncture was done; the fluid was under a pressure of 460 mm. and was clear; the pressure was reduced to 150 mm. by the removal of 10 cc. of fluid. The dynamics were tested. The jugular vein on each side was compressed, and the pressure rose to 420 mm.; when the vein was released it fell to 350 on the left and 300 on the right; both veins were compressed again, and about the same result occurred. The test, therefore, was apparently negative. The pressure did not return to 150 mm., with which we started.

DR. G. B. FRED: How often have the members observed fever caused by a furuncle itself?

DR. H. G. TOBEY: There can be some fever but not as high a temperature as in this case.

DR. G. L. TOBEY: I should like in some of these questionable cases to try the manometer test with the house officer. I am sure that in all of these proved cases of thrombosis one would obtain a positive reaction. Dr. Dandy feels that the test is fairly satisfactory. I feel that in this case there was something wrong in the technic.

PANSINUSITIS, DACRYOCYSTITIS AND MENINGITIS. DR. D. K. JUDD and DR. G. POIRIER.

A woman, aged 60, first entered this service on Dec. 5, 1923. She complained of tearing in the left eye for six years and in the right eye for three years. One week previous to admission the right eye became painful and began to swell, the swelling increasing until she was unable to open the eye. Moreover, for one week she had had pain in the right cheek, face and nose and severe, generalized headache. In June 1929 she had an extirpation of the left tear sac in the ophthalmologic service, but the tearing continued.

In October 1929, she had a submucous resection and right antrum puncture and pus was obtained. The reaction in the right eye and the pain subsided under local treatment, and on Dec. 11, 1933, six days after admission, a Toti-Mosher operation was done on the right side. There was no further tearing in that eye. Roentgen examination had shown bilateral pansinusitis with pus in both antrums; so on December 21, sixteen days after admission, a bilateral radical operation on the antrum was done. Following this severe, generalized headache again developed, which was difficult to control with medication. On Jan. 3, 1934, a Toti-Mosher operation was performed on the left side, i. e., on the same side on which extirpation was previously done. She had no further tearing, but the headache continued for about five days. She felt better and was discharged on January 10.

Two days later she was readmitted, stating that extremely severe headache began the night before and that she vomited several times. Local treatment was instituted, but the headaches continued. Neurologic examination gave negative results. The visual fields and the fundi were normal. Three days after admission lumbar puncture was done for diagnosis; this showed an initial pressure of 290 mm., 800 cells, 76 per cent of which were polymorphonuclears, and a strongly positive reaction to the Pandy test. Dr. Ayer suspected an abscess of the brain or osteomyelitis, but there were no clinical or roentgenographic signs of osteomyelitis. Lumbar puncture was done daily or every two days after that; the initial pressure was always between 200 and 300 mm., and the number of cells varied between 500 and 2,000. At times there was a suggestion of stiffness of the neck, but there were no localizing signs. The headache was the only evidence, except the results of lumbar puncture.

On January 23, eleven days after admission, Dr. Ayer said that exploration should be made for a brain abscess or an extradural abscess. That afternoon Dr. G. Poirier performed a bilateral radical operation on the frontal sinuses. The anterior wall and floor of each sinus were completely removed, and the sinuses contained thickened membrane and pus. Culture of each sinus showed staphylococci. A small opening was found on the medial side of the posterior wall of the right frontal sinus, so the entire posterior wall of that sinus was removed. No exploration of the brain was done. The report obtained from the State Laboratory on the next day was that the Wassermann reaction of the spinal fluid was strongly positive. Stiffness of the neck developed, and a bilateral Kernig sign and headache continued. The patient died on the third day after the operation.

DISCUSSION

DR. M. LYNCH: At autopsy, on removal of the dura the convolutions were found to be greatly flattened, owing to increased intracranial pressure. About the convolutions on the left side an accumulation of pus was found in the frontal lobe. Basilar meningitis was also found. The pus was thick and creamy. The olfactory nerve on the left side was friable. It gave way easily and appeared not to be nearly as firm as that on the right side. No tract could be found leading from any side of the operative area to the basilar meningitis; so one could not tell how the meningitis began. Both lateral ventricles were found to be full of equally thick pus. The arachnoid was thickened also. Grossly there was no indication of disease or infection within the brain. The sphenoid was not opened but removed for study.

DR. H. P. MOSHER: This case caused much anxiety to Dr. Poirier and has been excellently reported.

RHINOSCLEROMA OF THE TRACHEA. DR. D. K. JUDD.

This Russian woman, 31 years of age, entered the hospital on Jan. 3, 1934, with marked hoarseness for from five to six weeks. There was a history of occasional coughing spells. Five weeks ago a head cold developed, with marked increase in respiratory difficulty and a severe, irritative, nonproductive cough. The appearance of the larynx on admission was practically normal except for slight thickening and definite subglottic thickening with a whitish surface. It was dry, as though the secretions were adherent to the tracheal wall. Roentgenograms showed marked narrowing of the trachea just below the larynx and some decalcification of the anterior wall of the trachea for a considerable distance, three or four rings. Apparently, according to the lateral and anteroposterior views, the stenosis was annular. Examination of the nose showed a whitish area on the right inferior turbinate and a weblike scar across the nasopharynx. The patient had submucous resection done at one of the hospitals several years ago. Hinton and Wassermann tests made in the outpatient department were negative. A laryngectomy was done by Dr. Meltzer, and the larynx appeared normal. The trachea was found to be definitely thickened and constricted and admitted only a 4 mm. bronchoscope. A diagnosis of chronic inflammation was made, but a definite diagnosis was not possible. A section of tissue was not removed from the trachea because it was feared that abrasion of the surface in this region might increase the stenosis.

NOTE.—The patient's breathing improved, and there was little cough. No further operation on the trachea was done immediately. A specimen was obtained from the nasopharynx and from the turbinate. One month later, following moderate pharyngitis, she immediately became extremely dyspneic and cyanotic. She was brought to the hospital, and a tracheotomy was done. She has been comfortable since.

DISCUSSION

DR. P. MYSEL: Was tracheal rhinoscleroma considered?

DR. H. G. TOBEY: We intend to take a specimen in order to investigate that possibility.

DR. D. C. SMYTH: Why not do a tracheotomy now and take a specimen during the operation and also examine the upper end of the esophagus?

DR. P. E. MELTZER: I consider that the safest procedure.

DR. P. MYSEL: My associates and I have observed three cases of rhinoscleroma of the trachea in the past five years, and all of the patients have been Russians. This is a chronic, mildly infectious disease spreading through the greater part of the larynx. It usually begins within the nose, nasopharynx or subglottic region. In this patient's case there did not seem to be anything to account for the subglottic stenosis, and the fact that she is a Russian made me think of the possibility of rhinoscleroma. The symptoms are merely those of slight nasal or laryngeal catarrh. In the left nostril there was a white, hard obstruction. She had an operation on the septum, perhaps because of some obstruction between the inferior turbinate and the septum. On the right there is a dense, white plaque that does not have the characteristic hardness usually seen in such cases. In the nasopharynx there are many webs extending from the soft palate to the lateral pharyngeal wall. The nose, the nasopharynx and the larynx are three places that scleroma picks out. However, it may be confined to the trachea or subglottic region with occasional extension into the nasopharynx. The patients rarely die from rhinoscleroma. It is due to the Freisch bacillus. The organism is usually found in pure cultures in this condition, and characteristic hyaline bodies and Mikulicz cells are found in the section. Treatment is practically of no avail. All sorts of drugs have been used. Radium and roentgen therapy have been a possible hope.

DR. M. LYNCH: This section taken from the turbinate shows the mucous membrane on both sides, and on both it is seen to be greatly thickened. Below the mucous membrane there is extensive infiltration of round cells throughout the membrane. Changes are seen beneath the epithelium all the way down. There are light-staining cells, areas through the skin that appear something like follicles. On a high power view of this section one can see small molelike clusters of cells throughout. The cells stain lightly. The section shows a greatly thickened epithelium and a collection of plasma cells. These are the cells of Mikulicz. Also in areas under high power one may see what were plasma cells undergoing hyaline degeneration, and they form the hyaline cells that are found in this tissue. With the Gram stain these cells can be seen a little better. The Mikulicz cells are plasma cells that have undergone hydropic degeneration, the cause being the bacillus of rhinoscleroma, and in these cells may be seen the organisms, usually from six to eight.

DR. E. W. HERMAN: How contagious is the condition?

DR. P. MYSEL: It is mildly contagious. It rarely occurs in more than one member of the family.

DR. E. W. HERMAN: Roentgen and radium treatment are not particularly satisfactory. The literature was looked up. Somebody in Warsaw reported a series of one hundred cases, and reduced to a nutshell, the roentgen treatment used did not do any good to the scar already formed. Any scar could be removed with diathermy or by some other method. Roentgen treatment seemed to be beneficial in checking the further advance. The method of treatment was to remove all scar blocking the nose or nasopharynx and then apply roentgen radiation in the usual way. The total dosage required was enormous, although the areas were treated moderately; that is, treatment was given in the upper respiratory tract, nose, nasopharynx, pharynx, larynx and trachea, in a considerable series of moderate doses, the total dose amounting to more than 20,000 units. The net result was beneficial, but not brilliant. My associates and I have a patient in the tumor clinic who is being watched—the one who had a tracheotomy done here—but she has improved although she still has to wear a tracheotomy tube. The appearance of the larynx is becoming less irregular and rough. As the nodular appearance is still there, she will probably have to wear the tube. Six patients whose cases were reported from the Mayo clinic have shown improvement.

DR. M. LYNCH: There have been only twenty cases in this country since 1915, and all have occurred in Russian immigrants.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Regular Monthly Meeting, April 9, 1934

AUSTIN A. HAYDEN, M.D., *President, in the Chair*

MUCOCELE OF THE FRONTAL SINUS. DR. JOHN A. CAVANAUGH.

There should be more positive opinions as to the cause of mucocele of the frontal sinus. It appears that each writer expresses the opinion of the primordial writers and fails to look farther for the causative factors.

I believe that a frontal mucocele is the result of misplacement of an ethmoid cell with absorption of its bony walls and is not recognized unless a hyperplastic tissue change, or an infection takes place, causing a pyocele. It is not uncommon to see one or two ethmoid cells develop into the frontal sinus; Schaeffer called such cells "frontal bullae cells," the mucocele being a later development.

Race, social conditions and heredity play no apparent part. Toxic agents, dust, fumes, vapors and gases may predispose to these conditions. Just what effect disorders of metabolism may have is uncertain, but I verily believe they have much to do with this condition. Trauma, according to most writers, is a potent factor, yet I am skeptical as to this view. If it were such an important factor, there would be many more mucoceles. Bacteria seem to have no share in the causation of this condition. Up to the present one can but conjecture; one guess is as good as another.

Prophylactic measures might be helpful if one knew the reason for these changes. When the tumors are recognized, surgical intervention is the only sure procedure, the Killian operation or some of its modifications being used.

A case in which there was uneventful recovery following operation is reported in full.

DISCUSSION

DR. ROBERT H. FRASER, Battle Creek, Mich.: My direct observations have been limited to gross operative findings and to roentgen studies. Mechanically, there has been blocking of the outlet to the sinus, the primary disturbance being essentially in the soft tissues (mucoperiosteum). Mucocele therefore appears as a phenomenon in the course of chronic hyperplastic polysinusitis. (This point of view carries a hint for prophylaxis). Rarefaction, apposition, bone deposits in the membrane and osteoma are features in the course of this disease. When mucocele arises the rarefaction gives the egg-shell phenomenon, which in Dr. Cavanaugh's case extended to the partition between the frontal and the supra-orbital ethmoid sinus (injected). Primary roentgenograms are deceiving, as is illustrated in a slide which I present which shows fibro-osteosarcoma simulating mucocele. Osteoma was coexistent in two cases (outlet obstruction).

Radiopaque substances, preferably introduced by "displacement," reveal the condition of neighboring sinuses; hyperplastic thickening was seen in my cases. The surgical procedure may be influenced by such findings and by confirmatory evidence in metabolic readings and other associated complications, since rarely is the symptom complex confined to proptosis. In commenting on the employment of an injection of iodized oil in this case it is fitting that one should pay tribute to Dr. Cavanaugh as the pioneer American otolaryngologist in the use of opaque mediums in the sinuses. It is to be recalled that he was the first to make an injection of an opaque substance (barium sulphate suspension in the sphenoid sinuses, 1921). The modern widespread use of such injection and displacement is the fulfilment of his early dreams.

DR. FRANK J. NOVAK JR.: Dr. Cavanaugh in his excellent paper has reviewed everything that is known as to the etiology of mucocele of the frontal sinus, and yet practically nothing is known of the actual development of this pseudotumor. It is no more a true neoplasm than is a nasal polyp. I think that it is an intrasinus equivalent of a cystic polyp in the nose, and yet there is no proof of that. The fragments that are removed and studied histologically are difficult

to interpret, and until some one obtains an adequate specimen from a person who dies of some other condition and the mucocele is discovered and the frontal bone including the entire sinus is properly removed and serially sectioned, not much will be known of the histogenesis of mucocele. It occurs also in the maxillary sinus, and if some one stumbles on such a specimen it should be carefully preserved and studied in serial section.

DR. WALTER H. THEOBALD: Dr. Novak's statement is well made. Mucoceles appear sometimes as edematous growths, so to speak. I recall an episode which caused much chagrin. Dr. Pierce did an operation on an ethmoid, or on a sphenoid, sinus and a few days later found an enormous mass in the nose, which he called a polyp. It had all the earmarks of a polyp, but within a few days it disappeared. This was a mucocele. The structure sometimes disappears as mysteriously as it appears and has the consistency of edematous tissue.

DR. JOHN A. CAVANAUGH: I wish to thank Dr. Fraser especially for coming from Battle Creek to discuss this paper. I appreciate all that he has said, particularly his reference to the work I did on the injection of radiopaque solutions into the sphenoid sinus.

I believe, as does Dr. Novak, that it will require a great deal of careful observation before one can come to a real diagnosis of mucocele, for one is unable to recognize it until it produces some of the symptoms that I have mentioned.

FRONTAL SINUSITIS: CONCLUSIONS ARRIVED AT FROM OVER TWO HUNDRED INTRANASAL OPERATIONS. DR. ROBERT H. GOOD.

Since for more than a quarter of a century I have used the rasp for intranasal operations on the frontal sinus, I feel it my duty, if possible, to clarify some of the erroneous conceptions in the controversy as to external versus intranasal operations. The literature teems with statements that the intranasal operation is more dangerous. These statements are not substantiated by experience or facts.

Conservatism is the key word in the treatment of disease of the frontal sinus, but if by conservatism one means leaving acute frontal sinusitis alone for one or two weeks without giving the patient relief, that is not conservatism but neglect of duty. It is in the acute cases that the greatest opportunity lies to give instant relief and prevent the patients from becoming chronic sufferers.

Almost every frontal sinus presenting acute suppuration can be probed, not with a cannula, but with a cotton applicator of proper construction dipped in a solution of epinephrine hydrochloride and cocaine. When this has been accomplished the patient usually obtains relief whether one irrigates or not. If I find that I can pass a fair-sized cotton applicator into the sinus I leave it alone.

Irrigation should be done only when the ostium is large enough to allow free return of pus past the cannula, and the cannula should be moved to and fro during the syringing. If the ostium is small, suction is safer. If this procedure does not bring relief in a few days I bite out the ethmoid cells to the floor of the sinus. This is seldom required. I insist that an acutely inflamed frontal sinus presenting acute infection must be drained, but with the least trauma possible. I use a cotton applicator which is semiblunt at the end, not too small and fairly strong, so that some force can be used. The cotton must be firmly wound and long enough so that if it should pull off the probe the end would project out of the sinus. A moistened applicator is more efficient than any probe or cannula that I know of.

In the hundreds of cases in which I have probed the sinus I have never been obliged to amputate the middle turbinate. If I encounter a deviated septum which makes the probing impossible, I sterilize the nose and face and perform a submucous resection of the septum to make probing possible. In chronic cases the same conservative measures are carried out. The opening is made just large enough to establish drainage and relieve the symptoms. I have simplified my operation from that reported in 1907 in that I do not remove the anterior end of the middle turbinate except in cases in which there is danger of synechiae forming between the turbinate and the outer wall.

I have also discarded the protectors, as the posterior surfaces of the rasps are smooth, and I have discontinued the use of gold or rubber tubes for drainage on account of the discomfort to the patient. I have learned that the least possible irritation and manipulation after operation give the best results.

The complications which I have experienced in over three hundred intranasal operations performed with the rasp on the frontal sinus without fatality are as follows:

1. Fracture of the lamina papyracea resulting in orbital periostitis (one case).
2. Orbital hemorrhage or hemorrhage in the areolar tissues of the lids (three cases, resulting from injection into the anterior ethmoid nerve).
3. Orbital cellulitis (one case).
4. Edema and ecchymosis of lids (rather common).
5. The rasp entering the orbital instead of the sinus (two cases).

I observed one death from meningitis, in my fifth case, but I used Halle's burr and the burr broke at its attachment to the shaft.

Dr. Herbert Tilley stated: "I have an intensive preference for an instrument manipulated by the hand and guided by that indefinable but intimate sense of touch." I should like to add to this "an instrument guided by the sense of sight." Such guidance is accomplished by using a parallel ray operating light (such as the Kierstein or the recently devised Good light, which is a marked improvement over the former parallel ray operating light). All my operations were performed in hospitals, as it is almost impossible to be sterile in an office.

From thirty years' experience in work on the frontal sinus, I should say that in all cases of disease of the frontal sinus requiring operation, intervention should be performed first by the intranasal route, except in the presence of one of the following conditions: (1) mucocele, osteoma and other tumors; (2) meningitis; (3) a brain abscess; (4) thrombosis; (5) osteomyelitis; (6) an orbital abscess which has penetrated the periosteum with the pus around the bulb of the eye; (7) extradural irritation or abscess (for symptoms see my report in the *Illinois Medical Journal* [**36**:226, 1919]), and (8) an orbital abscess with pus between the sinus and the periosteum. In such cases the sinus can simply be drained externally, and when the inflammatory symptoms have subsided the intranasal operation will usually allow the fistula to close.

DISCUSSION

DR. FRANK J. NOVAK JR.: Many years ago at a meeting of this society Dr. Good presented a paper on an intranasal operation, and it precipitated a lively row. One of the things mentioned was the danger of meningitis as a result of this operation done in a field that is not readily visible. A report of three hundred cases in which there has been no such complication is of great importance.

Dr. Good said that he was able to probe and operate on the frontal sinus intranasally with great facility; yet fifteen other rhinologists were unable to probe the sinus. [Dr. Good interrupted to say that his case was one of a fistula.] I have had the same difficulty. Dr. Good has developed a technic and skill in this procedure which make it easy in his hands, and his results in three hundred cases prove his skill, but for the ordinary rhinologist who is not an expert I believe it is safer to do the external operation.

As to probing an acutely infected sinus early, there is some room for a difference of opinion. It has been shown definitely, particularly by Larsell and Fenton, that the frontal sinus is not well supplied with the cells that are involved in the reaction of immunity. Only after some infection has persisted for a long time, or some foreign body has been introduced, is the level of resistance raised; so it may be rather dangerous to enter a sinus until some measure of resistance or immunity has been established in it. Fenton has shown that after some antigenic substance has been injected into the frontal sinus of the cat the actual numerical content of macrophage is increased. After this has taken place, an operation

can be done with considerable impunity. If one enters a sinus too early and the immunity has not reached an adequate level, one is, in a measure, jeopardizing the patient's life.

In summarizing, if I had acute, or even chronic, suppuration of the frontal sinus, I should be happy to have Dr. Good operate on the sinus intranasally, but in his absence I should prefer to have another man do it externally.

DR. O. E. VAN ALYEA: This paper was well rendered. I like the idea of using motion pictures to describe surgical technic.

Some mention should be made of the anatomic connections in the nasofrontal region. There are many cases in which the opening does not come in contact with any ethmoid cells. In this group the operation described does not improve drainage from the frontal sinus, for the cells removed are all posterior to and nowhere near the nasofrontal channel. In certain respects the operation of rasping as described by Dr. Good in 1907 has held through all these years as a safe and effective method of enlarging the ostium frontale. A study of the frontal sinus on cadavers shows that the location of the distal ostium is toward the rear. Consequently, there is a wide area of the floor of the frontal sinus which may be rasped out without injuring the inner wall.

As to probing only, as a method of conservative treatment in the acute cases, this undoubtedly restores the natural pathways of drainage. Nevertheless, since an instrument reaches the ostium frontale, one can just as well use a cannula and irrigate the sinus, a procedure which not only restores the natural drainage but removes purulent material.

DR HARRY L. POLLOCK: I think that I am one of the "other fifteen." I believe that the statement Dr. Good made, especially in regard to the acute cases, is out of line with the beliefs of the average rhinologist. I have observed many cases of acute infection of the frontal sinus but have not had to enter the frontal sinus except in one case, in which the patient was a physician. I know that with conservative treatment and drainage acute cases can be cleared up. As Dr. Novak said, there are apt to be many complications in acute cases in which surgical intervention is done before sufficient resistance is set up. Dr. Good spoke of doing a submucous resection in acute cases. I think that this is against all surgical principles and should be discouraged.

Though I disagree with him as to the acute cases, in the chronic cases I think that he has done a great deal of good work. As I look back over the cases of chronic frontal sinusitis in which radical operation has been performed during the past fifteen years, it seems to me that equally good results would have been obtained by intranasal operation and that the mutilation resulting from the radical method would have been avoided. In the past few years I have made use of Dr. Good's method with good results. In the case of chronic infection with polypi or much pyogenic membrane, the intranasal procedure does not result in cure, but in my experience the radical procedure does not produce a cure either. So far as the end-results are concerned, I think that one procedure is as good as the other, but the intranasal operation entails less risk.

DR. T. C. GALLOWAY: What does rasping do to bone? I was not satisfied with the windows that I made in maxillary antrums until I stopped rasping. When a rasp was used there was exposed an area of bone from which excessive granulations sprang, with later adhesions, and in my experience that has been the principal thing that interfered with making a satisfactory window. When I was able to make a cleancut opening with a cutting forceps, it remained open. I have felt that rasping in the frontal sinus had somewhat the same effect. I think that I have had the best intranasal results following the operation on the frontal sinus which McGinnis advocated, the removal of the ethmoid cells which block the outlet. If there are marked changes in the sinus, I think that relief will not be obtained by cutting down the crest. If drainage is impaired because of a pathologic condition in the ethmoid cells or in the frontonasal duct, and if this is due in part to the turbinate and septum, those are the points of attack.

DR. JOHN A. CAVANAUGH: Dr. Good, in the early part of his paper, brought up the question of winding cotton around the applicator very carefully. A physi-

cian who had a frontal sinus infection for many years was in the habit of introducing a probe with cotton wound around it into the frontal sinus to produce shrinkage. He called me one morning and told me that while he was doing this the probe had broken off. Roentgenograms were made. The applicator end was lying crosswise on the floor of the frontal sinus. It seemed that the sure way to remove it was through the frontal ostium; as it was covered with cotton a probe could be introduced which, by turning about a few times, might catch on the cotton. I proceeded in this way and pulled some of the fibers of the cotton down into the nose; these were grasped with a forceps and pulled, and the cotton and broken end of the probe were removed. I asked to have the roentgenograms to present here, but the patient did not wish it.

I enjoyed Dr. Good's splendid paper and am in accord with most of his statements.

DR. ROBERT SONNENSCHEIN: I am not the person mentioned by Dr. Cavanaugh, but I did have an experience on myself. I have a fair-sized opening in my right sphenoid sinus, and when I occasionally have a severe headache I have been in the habit of taking an applicator, winding cotton on it tightly, as I supposed, and applying epinephrine or cocaine. Some years ago I did this, and the probe came out but the cotton remained in situ. I was out of town at the time, attending a meeting, and a skilful rhinologist was available who managed to get hold of the cotton and removed it.

I had the pleasure of seeing Dr. Good operate several years ago and can testify to his great skill in intranasal work. I wish to state that I am in agreement with Dr. Novak, Dr. Cavanaugh and Dr. Pollock regarding operations during acute infections and wish to recall the dictum of Dr. Pierce, not to operate in acute intranasal conditions if one can avoid doing so. I have found this excellent advice. In the first place, the usual conservative treatment will give relief in most cases. If marked deviation of the septum is present and there is infection on the same side, an incision must be made on the opposite side to prevent infection of the operative field. I can recall only one or two cases with symptoms of meningeal involvement in which external operation was necessary in the acute stage. In the chronic cases I realize that many patients operated on radically are not really cured, but I nevertheless believe that the intranasal operation should be attempted first. I have tried to follow Dr. Good's technic and have found that opening the ethmoid cells and then coming forward with the blunt rasp has enabled me to enter the frontal duct satisfactorily.

DR. SAMUEL SALINGER: I do not know whether I understood Dr. Good as the other speakers did, but it did not seem to me that he suggested the use of his rasp in acute infections of the frontal sinus. I agree with him heartily that in acute frontal sinus infections an attempt should be made to pass a probe into the duct in order to facilitate drainage. I think that the reason some otolaryngologists are not so skilful at it is that they do not try it often enough to acquire facility. Several years ago laryngologists were very skilful in removing growths from the larynx by the indirect method, a procedure that is now practically in the discard. I know a few otolaryngologists who claim that it is difficult for them to pass a cannula into the maxillary sinus. On the other hand, there are others who claim that in 90 per cent of the cases they are able to enter the natural ostium. The number of cases that Dr. Good mentioned could be multiplied many times in terms of the total number of probings he has done.

The discussion of the treatment of acute infections of the frontal sinus that took place this evening, I think, is beside the question. Dr. Good described his operation for chronic conditions and, further, mentioned the cases in which it is contraindicated. The early closure of artificial openings into the maxillary sinus made with the rasp as mentioned by Dr. Galloway is not comparable with what happens in the nasofrontal duct for the reason that the latter is a normal passage lined with mucous membrane which will tend to regenerate if not entirely destroyed. In the nasofrontal duct Dr. Good said that one should be very particular to retain the mucosa in the duct. He pointed out the necessity of avoiding trauma to the posterior lining of the duct and constructed his rasp with that idea in mind. The

operation has its indications. The question is whether one sees the same indications that Dr. Good does. In my experience I have found less occasion to do the operation than he has.

DR. ROBERT SONNENSCHEIN: I did not come into the room until almost the end of the presentation of the pictures, and I was led from the discussion to believe that Dr. Good advised this procedure in acute cases. I apologize for my statements regarding this point, for I had been misled.

DR. CHARLES B. YOUNGER: In dealing with the acute cases, I recall the teaching of Casselberry and some of the other early otolaryngologists, and I have learned to be timid in operating for frontal sinus infection. One may take liberties with the maxillary sinus because it has not a close connection with the brain and with the dura. I shall not enter into the discussion of handling cases of acute frontal sinus infection, but I wish to call attention to a fact, to which I think most of the members will agree, that some of the objections to the external operations have been removed. All otolaryngologists have seen persons who have been operated on externally with most gratifying results. European methods have been demonstrated in which a great deal of tissue was taken and in which the operators were not restricted by the cosmetic results as are surgeons in this country. One must be very careful as to the cosmetic results. Many of the deformities that resulted from external operations many years ago are not seen today. It is possible to use the external approach, with which one can have good inspection and can leave the field clean, with primary healing as a rule and without deformity. I have seen many cases in which there was no sinking or deformity following operation.

I wish to mention a case of infection of the frontal sinus in which an external operation was performed in the acute phase. A rhinologist operated, making a small opening and attempting to probe the frontal duct, going from above downward. The probe missed the duct and found its way underneath the mucosa of the septum. An acute infection was carried down into an otherwise clean field, with the result that the patient had a complete saddle-bag nose. One, therefore, must deal with acute infections in the frontal sinus as one deals with acute infections elsewhere, that is, with due caution because of the frequent high virulence.

DR. FRANK J. NOVAK JR.: Dr. Galloway mentioned the exuberant granulations resulting from rasping of the bone in operations on the maxillary sinus. That is due not to the rasping of the bone but to the excessive trauma of the soft tissues. If the soft tissues are carefully incised with a good instrument the procedure does not result in unnecessary granulation.

DR. ROBERT H. FRASER, Battle Creek, Mich.: The roentgen rays may aid in the determination of the extent to which the use of the rasp will be necessary. Lateral views frequently delineate the anterior ethmoid cells (and in the less advanced cases iodized oil will enter them by "displacement"). Large, thin-walled cells in series with the frontal sinus invite one to omit the use of a rasp in these cases, in which operation is to be performed with the biting forceps. If extensive thin partitions are removed, no dense or cancellous bone is disturbed.

DR. ROBERT H. GOOD: I shall give another quotation from Herbert Tilley, of London: "The cases of chronic suppuration of the frontal sinus which call for external operation are few. For reasons already given it seems to me to the contrary. The intranasal operation should be given precedence in our attempt to cure or relieve the patient's symptoms. Serious complications are much less frequent than with the more radical external operations. I have been practicing this operation for three years and so far have had no fatality nor osteomyelitis. For two years I have not performed an external operation but about thirty intranasal operations without fatality."

One could mention many other men, for instance Pierce and Mosher, who would say the same thing.

Dr. Novak recalled the meeting at which I first presented this subject in 1907, when Dr. Shambaugh came with specimens showing that the operation could not be done. The thing that Dr. Shambaugh overlooked, and that a great many

physicians overlook, is that a diseased sinus is different from the normal specimen that one finds in the laboratory. A diseased sinus is always a good-sized sinus. It is the small sinus that one cannot probe. Dr. Corwin thought that I had to go through the hard palate to get up in the sinus.

One of the discussers said that I observed no complications. There have been a number, but there have been no deaths.

As to probing being dangerous, if one does not know how to anesthetize a patient it is difficult. The first requisite is that the patient should feel little pain. The next is to have the patient lying down so that one can be accurate in one's movements. A probe that is moistened with a solution of cocaine and epinephrine should be used, and this anesthetizes as one proceeds. One must have a fairly strong probe with cotton at the end that is wet with cocaine and epinephrine. In this way I think that there is no great danger in probing a frontal sinus in acute cases. There is much question as to whether one should irrigate an acutely inflamed frontal sinus, as I mentioned in my paper. In such cases, if one probes the sinus and stretches the opening a little with the probe, nature will do the rest, and the patient will recover.

About the different locations of the osteoma, which Dr. Van Alyea mentioned, the first thing that I attempt after the patient is quiet and has no pain is to drop the probe over the infundibulum, but that cannot always be done. If I cannot do that I do not hesitate to put the probe through an ethmoid cell and get into the frontal sinus.

Dr. Pollock is perfectly in harmony with my ideas as to operation on infected frontal sinuses in the chronic stage because he has done such operations. But what about the acute cases if he has not tried the operation in them? He says that it is dangerous. How can one say that a certain procedure is dangerous when one has had no experience? I do not consider this procedure any more dangerous than going into the antrum. I believe in doing everything that will bring results, but if a patient suffers for several days after all other methods of treatment have been used I get busy and do not let him suffer any longer.

Dr. Galloway was answered by Dr. Novak as to the granulations. I do not use a rasp in the antrum extensively. I use chisels and bone forceps, but I finish up with the rasp and leave the surfaces smooth.

Dr. Salinger spoke of my skill. I am no more skilful than others, but one has to sleep with anatomic specimens to know them. The ordinary head mirror is not efficient for such deep intervention, as the focal point of the mirror is about 1½ inches (3.5 cm.) from the front of the nose, and for areas farther in one sees only with light reflected from the membrane. The parallel light has no focal point and enables one to see distinctly in deep cavities.

Dr. Younger brought out an important thing. I had one accident like the one that he mentioned, and that was because I used a cannula to probe a frontal sinus. Dr. Van Alyea has a probe with a blunt nose and the irrigating outlet on the side, and I wish to compliment him on it. In my case the cannula went between the mucous membrane and the bone above the septum, and I irrigated and some of the solution entered there and caused swelling of the septum. I did not know this until two days later when I saw an aquatoma. I made an incision, and everything went along all right. For that reason I do not like to use a cannula, except Dr. Van Alyea's.

The complications were all mentioned in my paper, and I do not wish any one to think that I have had none.

LOCAL ANESTHESIA IN OTORHINOLARYNGOLOGY: A HISTORICAL RETROSPECT. DR. JAMES E. LEBENSOHN.

This year, 1934, is the fiftieth anniversary of the introduction of cocaine as a local anesthetic. Jonathan Wright, in his "History of Laryngology and Rhinology" (Philadelphia, Lea & Febiger, 1914), declared that the three greatest events in the history of modern laryngology and rhinology are the demonstration of the

utility of the laryngoscope by Czermak and Türck, the observation of adenoids by Wilhelm Meyer and the advent of cocaine.

The discovery of local anesthesia was of greater significance to otorhinolaryngology than was that of general narcosis. Previous to the arrival of cocaine, the only intranasal operation performed was the more or less exact removal of polypi. Since then operative interventions have enormously increased, and yearly more and more are being done under local anesthesia.

The early laryngologists vainly attempted to control the laryngeal reflexes by the topical application of various medicaments, such as potassium bromide, chloroform and morphine, which often proved dangerously toxic, and which are effective, as is now known, only through their systemic action. Finally the laryngologists contented themselves with seeking the cooperation of the patient through training. The patient practiced twice daily until he learned to suppress the cough reflex when the larynx was touched. Weeks or months often elapsed before the patient was pronounced ripe for operation.

After Carl Koller had demonstrated the anesthetic action of cocaine on the cornea and conjunctiva, his friend Edmund Jellinek essayed the use of cocaine in laryngologic operations. After his report, his chief, Schrötter, prophetically averred: "The technical difficulties in laryngeal surgery have now been overcome." The work of Jellinek was soon confirmed by Geier of Heidelberg and Felix Semon of London. Before the year 1884 was over, Lermoyez had performed tonsillectomy, and Heymann, adenoidectomy, under local anesthesia. In 1898, Bonain introduced a mixture of menthol, cocaine and phenol to anesthetize the drum membrane. Blegvad, in 1912, substituted for Bonain's formula equal parts of salicylic acid, cocaine and alcohol. In 1904, Neumann demonstrated that the entire middle ear could be anesthetized by the injection of cocaine under the periosteum in the posterosuperior portion of the canal near the drum, and in the same year von Eicken performed the first radical operation on the antrum under local anesthesia.

Since the introduction of local anesthesia, America has been active in its development. Bosworth introduced cocaine in rhinology and advocated its use for hay fever and to distinguish turgescence from true hyperplasia. Knapp, Bettman and Ingals extended the use of local anesthesia to the removal of polypi, galvanocautery and interventions on the tear duct.

In surveying this semicentenary of the use of local anesthesia, otorhinolaryngology may well be proud of the progress achieved. Surgical technic has developed hand in hand with pharmacologic advance, so that now, given the cooperation of the patient, almost any surgical venture can be as successfully undertaken under local as under general anesthesia. The monographs on the subject—Caesar Hirsch, 1925; J. J. King, 1926; G. Portmann and P. Leduc, 1928; G. Canuyt and J. Joublot, 1930—indicate that today the field of local anesthesia presents few, if any, technical barriers.

DISCUSSION

DR. ROBERT SONNENSCHEIN: History relates the progress of mankind. He who is interested in this narrative will look for the milestones which mark progress from generation to generation. In view of the important rôle which anesthesia plays in the surgery of otolaryngology, it is most fitting that one celebrate this semicentennial of the discovery of local anesthesia. The members are indeed grateful to Dr. Lebensohn for his timely, excellent paper on this subject.

As my listeners are probably aware, my hobby for many years has been, and much of my interest has been centered on, the collection of medical portraits and the study of the history of medicine, and this has led to contacts with many delightful personalities. Through the son-in-law of Dr. Carl Koller, I had the privilege of becoming acquainted with him and of visiting him in his office in New York City a number of times during the past few years. His is a most charming personality, quiet, dignified, courteous and cordial. Although over 76 years of age, he still devotes a few hours a day to his office. He was born on Dec. 3,

1857, and was educated at the University of Vienna, where he conducted biologic research on the origin of the mesoderm in the embryologic development of the chick. He was the first to make use of cocaine for the purpose of local anesthesia. In New York City, where he has been located for many years, he has held a number of positions, among them that of consulting ophthalmic surgeon of Mount Sinai Hospital, of the Montefiore Hospital and of the Hebrew Orphan Asylum. He is a member, not only of the American Ophthalmological Society, but of the German Ophthalmological Society of Heidelberg, the Royal Academy of Medicine of Rome and the Royal Society of Medicine at Budapest.

The development of local anesthetic agents which may be used both subdermally and submucously has proceeded rapidly, so that there are now numerous preparations, many of which have been noted by the essayist. I have found procaine hydrochloride the most satisfactory of these, and it has served especially well when used for nerve blocking, either for tonsillectomy or for operations on the nasal accessory sinuses. You will, do doubt, recall that the committee on the study of the toxic effects of local anesthesia appointed by the American Medical Association in 1919, on which I had the honor of serving with the late Dr. Emil Mayer, made an exhaustive survey of this subject. From all we could learn, procaine hydrochloride seemed the safest local anesthetic in use at that time.

For topical application, however, especially to produce good anesthesia for intranasal operations, I believe that nothing surpasses the action of cocaine. When one considers that it was really due to the discovery of the local anesthetic effect of cocaine that the active development of the surgical intervention on the eye, nose and throat was made possible, one can easily second the statement made by Dr. Lebensohn that "the official demonstration by Dr. Carl Koller before the German Ophthalmological Society of Heidelberg, Dec. 15, 1884, ranks with the famous first public operation under ether by Morton at the Massachusetts General Hospital in 1846." Rarely does a great pioneer in any line have the good fortune to receive within his own lifetime the proper recognition of his achievements. I believe that it is, therefore, a most unusual and felicitous occasion on which one celebrates the semicentennial of the great discovery by Dr. Carl Koller, particularly in view of the fact that he is still in the flesh. We of the profession are to be congratulated on what he did for us and on having the opportunity of celebrating the fiftieth anniversary of his great contribution. I suggest that the Chicago Laryngological and Otological Society send a message of congratulations and good wishes to Dr. Carl Koller.

DR. FRANK J. NOVAK JR.: It may be of interest that Dr. Koller will be in Chicago in September 1934, at the meeting of the American Academy of Ophthalmology and Otolaryngology, to receive the medal which was referred to.

DR. HOWARD C. BALLENGER: One hears a great deal about the use of cocaine mud, and perhaps it is not generally known that it is much safer to make this mud from flakes than from crystals. The only reason that I know for this is that the granules do not dissolve as easily as the flakes and hence penetrate the mucosa with the resultant increased absorption. This fact is not universally recognized, and I thought that it might be well to call attention to it.

DR. JAMES E. LEBENSOHN: It is interesting that now, fifty years after the discovery of the anesthetic action of cocaine, cocaine itself could be dispensed with, though without it one would never have had local anesthesia. For nasal operation cocaine exerts a combined astringent and anesthetizing action which is duplicated by none of its substitutes. Practically all of them produce hyperemia, except isococaine tartrate which does not have any action on the blood vessels.

The book by Hirsch, of Stuttgart, on local anesthesia in the ear, nose and throat is extremely valuable. He gave in detail the interesting work on the innervation of the drum membrane by Dr. Gordon Wilson. He also tells us about his cocaine-sparing solution, 3 per cent cocaine in 0.5 per cent phenol, which equals in power the usual 10 per cent solution of cocaine. Another valuable suggestion is that by making up procaine hydrochloride solution in a 0.25 per cent solution of potassium sulphate its effectiveness is doubled.

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